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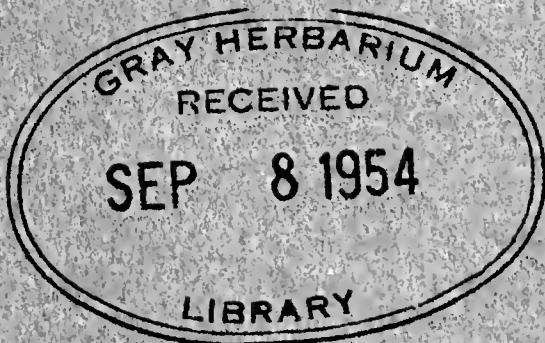
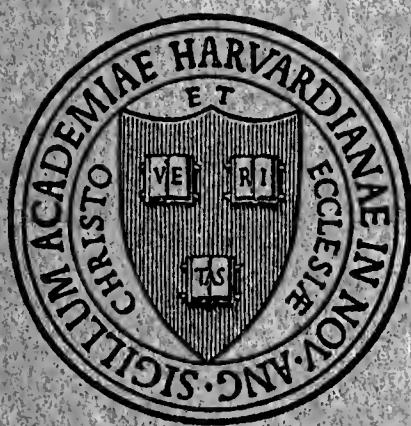
VI

PHYTOGEOGRAPHIC STUDIES  
IN THE  
PEACE AND UPPER LIARD RIVER  
REGIONS, CANADA  
WITH A CATALOGUE OF THE  
VASCULAR PLANTS

BY

HUGH M. RAUP

WITH NINE PLATES AND A MAP



PUBLISHED BY  
THE ARNOLD ARBORETUM OF HARVARD UNIVERSITY  
JAMAICA PLAIN, MASS., U.S.A.  
1934

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OF HARVARD UNIVERSITY

A publication issued at irregular intervals by the Arnold Arboretum of Harvard University.

The issues of this publication can be obtained from the Arnold Arboretum, Jamaica Plain, Mass., U. S. A. All correspondence relating to exchange for publications of institutions and societies should be addressed to the Librarian, Arnold Arboretum, Jamaica Plain, Mass., U. S. A.

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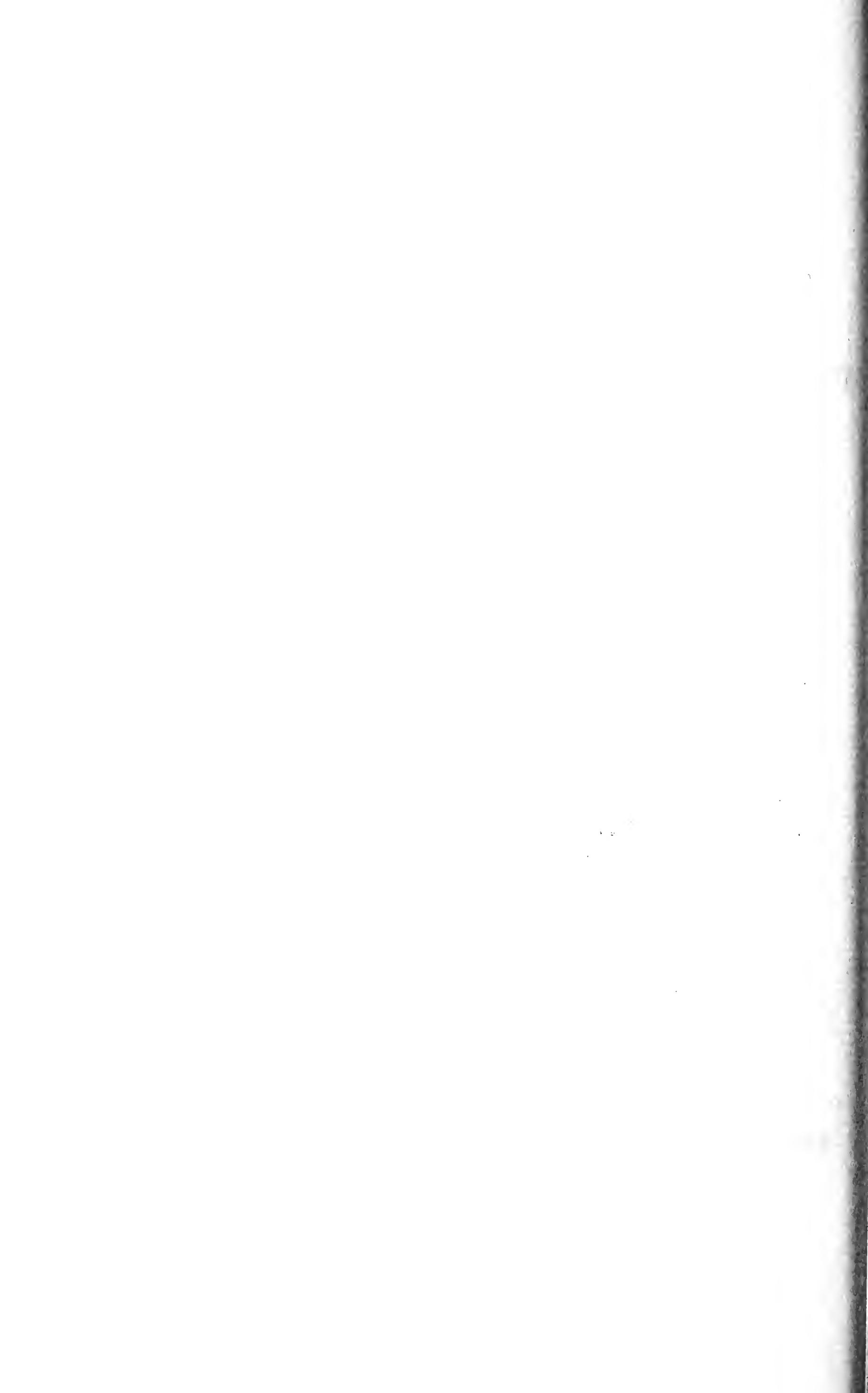
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No. VI, pp. 1-230, plates 1-9, map

Issued February 15th, 1934

Printed on Worthy Permanent Book Paper  
by ELIOT PRESS, INC.  
BOSTON, Massachusetts, U. S. A.

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# PHYTogeographic STUDIES IN THE PEACE AND UPPER LIARD RIVER REGIONS, CANADA

## WITH A CATALOGUE OF THE VASCULAR PLANTS

### INTRODUCTION

Nearly a century and a half have passed since the first European travellers succeeded in pushing their way through the northern Rocky Mountains by way of the Peace River. Since that time a host of travellers and traders, following the northern and southern tributaries of the Peace into the vast hinterland of northeastern British Columbia and adjacent Alberta, have left us a wealth of observations on the configuration of the land and its natural productions. However, but few botanical collectors have ever gone there, and still fewer have attempted to make complete collections. Consequently, the number of precise and verifiable records of the flora has been so small that the whole area has remained almost unknown botanically. In the course of extended floristic and geographic studies in the central and northern portions of the Mackenzie basin there has arisen repeatedly a need for a survey of these records, and also for the enlargement of our knowledge of the southwestern section of the basin. The present paper embodies an effort to gather into one place as much of the earlier information as possible, and to describe the results of the Arnold Arboretum expedition to the Peace River district in 1932.

The region is one of great phytogeographic interest. It is in the zone of close inter-relationship between the American arctic and alpine floras, and should throw new light upon the origin and development of each. It marks a transition from the cordilleran forests to those of wide range in northern Canada. And it contains a great deal of evidence, in a virtually undisturbed condition, of the manner in which the land surfaces exposed at the close of the Pleistocene have acquired their cover of vegetation. The flora of the extra-cordilleran parts of the basin has proved to be prevailingly northeastern North American in its affinities, but there is a certain percentage of western species whose sources and

routes of migration have demanded investigation. Also, it is of great interest to know how far westward in middle Canadian latitudes the strong northeastern influence is felt. Available information on these matters has existed here-to-fore only in a scattered condition: part of it in the form of miscellaneous notes in the narratives of travellers, part in the form of plant lists the accuracy of which can never be proved because of the lack of specimens, and part as herbarium material with or without accompanying published lists.

The catalogue with which the paper closes includes an annotated list of plants collected during the writer's journey of 1932 and a fairly comprehensive enumeration of collections made by others in the same general region. In the cordilleran area the boundaries are roughly defined by the heights of land surrounding the Peace and Liard River drainage basins. Southward in the central plain the Lesser Slave Lake district has been included, but no other part of the Athabaska basin. Eastward, likewise, the boundary has been drawn rather arbitrarily at about the Vermilion-Carcajou district, and does not include any of the Mackenzie River valley. The region covered is thus seen as the southwestern portion of the Mackenzie basin north of the Athabaska River, embracing parts of northeastern British Columbia, northwestern Alberta, and southeastern Yukon. A complete list of the 1932 specimens would include many from Lake Athabaska, but these records will appear in a later paper on the flora of the Mackenzie basin.

Due to the meagerness of the accumulated data, the present enumeration must be regarded only as a working basis for future study, particularly for the country north of the Peace River valley proper, and must in no sense be considered a flora.

Herbaria consulted in the preparation of the catalogue, with the symbols used, are as follows: Arnold Arboretum (A), New York State College of Agriculture at Cornell University (C), Gray Herbarium (G), New York Botanical Garden (N), National Museum of Canada, Ottawa (O), Academy of Natural Sciences of Philadelphia (P). Numbers and records not accompanied by the name (in italics) of the collector or other authority, and separated by a dash, are those from the expedition of 1932 and stand first in the order of citation. The writer believes the records are fairly complete for the herbaria noted. Some of Mr.

Brinkman's numbers have not been easily accessible and so have not been included, but judging from records at hand they represent species of which other numbers are cited. There are undoubtedly miscellaneous collections from the region scattered through other herbaria, particularly that of the University of British Columbia, but these have not been readily available and have had to be disregarded for the time being. Some of the collections made by Thomas Drummond (26)<sup>1</sup> at the time of the second Franklin Expedition (1825—7) probably came from the southern headwaters of the Peace (Smoky R.), but although the writer has examined much of this Rocky Mountain material it is impossible with the data on the sheets in American herbaria, or with the notes in *Flora Boreali-Americana* (35), to classify it geographically with accuracy.

Notes on frequency have been omitted from the list, chiefly for lack of knowledge. Sparse or unauthenticated records for any given species should not be considered, therefore, as indicative of its rarity. Reference to the list will show that such common or even weed-like forms as *Eleocharis acicularis*, *Juncus bufonius*, *Typha latifolia*, and *Plantago major* var. *asiatica* are given rather limited ranges by the known records. For the relative abundance of many species in local areas reference should be made to the geographic notes. Aquatic plants are notable for their scarcity in the catalogue, but this is no indication that they do not occur. Such common forms as *Myriophyllum exalbescens*, *Ceratophyllum demersum*, other species of *Potamogeton* and *Sparganium*, are undoubtedly common, but we have at present no specimens or records to show for them. Future students should find ample opportunity for making substantial additions to the flora in these and many other groups.

Where records are not substantiated by actual specimens, or, as in the case of a few Brinkman notes, the writer has not yet seen the plants, the paragraphs referring to these records are printed in smaller type and the names in capitals and small capitals. No attempt has been made to include an exhaustive list of these unverified records, only those being used which make provisional additions to the known flora. To introduce others for the sake of possible range extensions would be to increase greatly the percentage of error in the whole catalogue since it is difficult to de-

<sup>1</sup> Numbers given in this way refer to citations in the bibliography.

cipher the significance of many of the names used. The long list published by John Macoun in his report for 1875 (57) probably contains some additions, but his geographical divisions make it impossible to segregate them. His division IV includes both the Peace and Athabaska basins as far east as Methye Portage, while his III (Rocky Mountains) reaches as far south as the 49th parallel. Consequently only those 1875 records have been used which occur in his narrative proper.

For notes on itineraries and collection localities reference should be made to the historical sketch.

The order and definition of the families is that of Engler and Gilg's *Syllabus der Pflanzenfamilien* (9th and 10th editions), and the order of genera within the families is taken from the same work except in a few cases, such as the Gramineae, in which a more commonly accepted usage is followed. The International Rules of Botanical Nomenclature have been used in the selection of names as far as possible, and only those synonyms have been included which will make the list referable to the current manuals touching the region.

The Peace River, largest of the three major tributaries in the Mackenzie drainage system, rises in a great valley west of the Rocky Mountains where it receives most of its waters from two other streams. One of these, the Parsnip River, has its origin near the northern headwaters of the Fraser not far from the town of Prince George on the Canadian National Railway. It takes a generally sluggish course northward through a series of lakes and lowlands to about lat.  $56^{\circ}$ , where it meets the southward-flowing Finlay River. The latter stream rises in northern British Columbia near the headwaters of the Stikine and Liard Rivers, and flows over a hundred miles in a nearly straight line through the same "Rocky Mountain Trench" which holds the Parsnip.

From the junction of these two streams the Peace flows almost directly eastward through a pass in the Rockies at an altitude of about 2000 ft. above the sea. The mountains on either side tower to about 7000 ft. just east of the junction, lowering to about 4000 ft. at the east end of the pass. Although there are only minor obstructions in the pass itself, at the eastern side of the mountains where the river starts across the plains it passes through a narrow, totally unnavigable defile which has been known since the earliest coming of the white men as the "Canyon of the

Mountain of the Rocks" or "Rocky Mountain Canyon". Here the stream is in places no more than 50 yards wide with nearly vertical cliffs on either side, and in a distance of 25 miles its fall is about 275 feet.

Beyond the mountains the river maintains in general an easterly course across the great central plain of the Mackenzie basin nearly to the present site of the town of Peace River Crossing (Peace River Landing), where it turns northward. Thence it flows to about the latitude of the western end of Lake Athabaska, and from there northeastward to its junction with the Slave River. Where it leaves the mountains its comparatively narrow valley is cut approximately 600 ft. into the immediately surrounding plateau, whereas at Vermilion Chutes, about 550 miles below, the banks are only a few feet high and the river meanders in a broad lowland. With the exception of rapids below Vermilion the river is navigable for boats of shallow draft throughout the entire distance of about 750 miles from Hudson Hope to the Slave. Many tributaries enter in this long stretch, the largest being the Smoky River which rises in the mountains south of the Peace and enters the main stream just above Peace River Crossing.

Like so many vast areas in northern Canada, much of the country "inland" from the Peace, particularly to the north of it, is very imperfectly known, but the main outlines of its topography are available. The highest land consists of more or less isolated plateaus which reach elevations of from 2000 to 3500 ft. above sea level. The intervening lands are variously modified, particularly by Glacial and post-Glacial geologic activity, but in general they slope northward and eastward so that the higher plateaus become more prominent, although farther back from the major streams, the farther one goes in these directions.

At ordinary water levels the Peace discharges all of its water into the Slave River, and through this river into Great Slave Lake, but at flood times a large portion enters the western end of Lake Athabaska through what is known as the Quatre Fourches River. Operating through long ages this flood-time activity of the Peace, laden as it is with enormous quantities of drift timber and sediment, has formed broad delta plains with all their peculiar topographic forms in the lowlands of the upper Slave River and in the shallow western end of Lake Athabaska.

Only the upper part of the Liard River basin is involved in the present paper. Like the Peace, this tributary of the Mackenzie rises west of the Rocky Mountains and flows eastward through a canyon-like valley to the central plain. Its headwaters are composed of four streams: the Kechika River rises in the Rocky Mountain Trench not far from the upper Finlay, the Dease River heads in Dease Lake near the headwaters of the Stikine, while the Frances and the Liard proper rise among the upper tributaries of the Yukon. All of these streams are much broken by rapids, and are navigable only with difficulty. As will be shown in the following historical sketch, the upper Liard basin is one of the least-known parts of the whole Mackenzie region.

#### ACKNOWLEDGMENTS

Most of the work on earlier collections noted in the list of the flora was made possible by a fellowship grant from the National Research Council, and a part of the cost of the 1932 trip was also met by these funds, for which the author is deeply grateful. The greater part of the expense of the trip was defrayed by the Arnold Arboretum. The National Museum of Canada has given very real assistance by the generous loan of maps and field equipment; and through the good offices of its Chief Botanist, the late Dr. M. O. Malte, it has placed at the author's disposal for study its extensive herbarium material. Other institutions to which special thanks are due are the New York Botanical Garden from which most of the A. H. Brinkman plants were loaned, the Academy of Natural Sciences of Philadelphia from which Mrs. Mary G. Henry's collections were obtained, and the New York State College of Agriculture at Cornell which loaned a few of the Brinkman specimens. Much of the work has been done at the Gray Herbarium, to whose staff the writer is indebted in ways too numerous to mention. Several individuals have been especially helpful: Mrs. Henry, Mr. Brinkman, Dr. E. H. Moss of the University of Alberta, and Mr. W. G. Sheldon have all been most kind in presenting personal notes on their respective collections; Professor M. L. Fernald has given freely of his knowledge and skill in the determinations of many difficult groups of plants, and has generously contributed descriptions for two of the new species; Mr. Alfred Rehder has provided helpful criticism in the determinations of ligneous plants; Mr. C. A. Weatherby has checked most of the

ferns and fern allies; and Dr. F. W. Pennell has determined many of the Scrophulariaceae. Finally, the writer wishes to express his profound appreciation of the unfailing enthusiasm of his co-workers in the field, Mrs. Raup and Dr. E. C. Abbe.

## HISTORICAL SKETCH

### 1778—1804

The facts relating to the discovery of the Peace River are not at all clear. There came a winter, 1777—8, when trade in the Churchill and lower Saskatchewan River countries failed to show a profit, and a small group of traders including Alexander Henry and Joseph Frobisher, with others to whom they were related by way of a loose partnership, found themselves with a stock of goods which they could not turn over. They accordingly held a meeting in the summer of 1778 and gave to one Peter Pond a supply of goods for a venture into an unknown western country of which only Indian report was then available. Much of the subsequent early history of the Mackenzie basin is closely related to Pond's ability and character, but for present purposes only his rather questionable knowledge of the Peace River will be noted. In the autumn of 1778 he entered the Clearwater River by way of the Methye Portage, travelled down this stream and the Athabaska River, and established a post at the head of the latter's delta, probably near the beginning of what is now called the Embarras Channel. In so doing he opened a way which for many years continued to be the principal trade route into the Mackenzie basin (41).

The post at the head of the delta was occupied for several years, serving as a forerunner of the original Fort Chipewyan which was on the south side of Lake Athabaska. Pond stayed in the region, except for trips out with furs, until 1788. The activities of himself and his associates during this period are not accurately known. There is some indication that he built posts on the lower Peace, on the north shore of Lake Athabaska, and on the south shore of Great Slave Lake, but judging from his own sketch maps, 1785 and 1789, he had little or no first-hand knowledge of any of the country north of his original post. His Peace River is shown on one map as flowing northward to Great Slave Lake, and on another into the Slave River far below its actual position (5, 41).

There is some doubtful evidence that trading on the Peace

River was begun in the fall of 1787 by men from Pond's house who set out overland to the northwest. In the winter of 1788—9 it is known that a post was established by Boyer at "Fish River", the identity of which is still uncertain. One of the more recent students of the subject, J. N. Wallace (100), thinks it was probably near the present site of Vermilion, but on the north side of the river. The Peace was "discovered", therefore, probably by Peter Pond or traders serving with him, in the country which lies west of Lakes Claire and Athabaska, and the early knowledge of it was attained mainly by expeditions upstream from this region. For many years all trade into the valley of the Peace was carried on via the Clearwater and Athabaska Rivers, even after the business was extended beyond the Rocky Mountains and established in the upper Columbia and Fraser River countries. An overland route by way of Lesser Slave Lake, reaching the Peace near Smoky Forks, had soon come into use by the white men but only as a way for rapid communication with the prairie posts to the southward.

Although a great deal has been written about the Peace River relating to travel and trade, and later to agricultural development, only a small portion of the literature is of outstanding interest as regards the flora and its distribution. Except in a few cases descriptions are limited to general aspects of the vegetation, while in still fewer cases are there actual specimens showing what the writers were describing. In the following pages the general accounts must of necessity be given little attention, but those of more precise botanical significance will be described in some detail.

Alexander Mackenzie set out from Chipewyan in October, 1792, to explore the upper Peace River and to find if possible a way over the mountains to the Pacific (60). In leaving Lake Athabaska he states that his party went to the Peace by way of Pine River, a route through the delta which has long been out of use. Judging by the apparent ease with which this traverse was made the water level must have been higher at that time than it is now. Early in the narrative Mackenzie gives a version for the origin of the name of the river. The northern Cree tribes which now inhabit the country south of the lower Peace invaded this territory from the south, driving the Beaver and Slave Indians before them. The former retreated up the Peace from

Lake Athabaska and finally patched up their troubles with the invaders at Peace Point, thus giving a name to the place and to the river.

Mackenzie and his party proceeded upstream with but few stops until they reached a point on the south bank about six miles above Smoky Forks. Here they established winter quarters and carried on a trade with the Indians. On May 9th of the following year they again set off up river, this time to complete their undertaking. After a difficult and hazardous passage through and around the Rocky Mountain Canyon, finally accomplished on May 25th, they made their way through the Peace Pass and up the Parsnip River. By a rapid journey through the uncharted wilderness of central British Columbia they reached the coast on July 20th, and by August 24th had completed the return to Chipewyan. Mackenzie's simple narrative is replete with interesting and valuable notes on the natural history of the regions he traversed. He gives detailed sailing directions for nearly all of his journey on the Peace River, and although his estimates of distance are often faulty his descriptions of landmarks and points of interest are usually clear and include accurate accounts of the types of vegetation as he saw them.

Perhaps the most important contributor to geographic knowledge in western Canada was David Thompson (96), who laid a remarkably accurate foundation for later maps of this vast region. Thompson's master hand was not seen on the Peace except for one brief journey from Rocky Mountain House to the Slave River in 1804, during which he made notes on the course of the river and the distances traversed.

#### 1804—1872

There followed a long period after the journeys of Mackenzie and Thompson, and extending to 1872, when very few additions were made to the general knowledge of the region. This period, with a few subsequent years, represented the heyday of the fur-trade. There was a continual and exceedingly profitable traffic, with nothing less than open <sup>see</sup> warfare between the two great rival houses — the Northwest and Hudson's Bay Companies. It was soon realized by both that the excessive competition was doing more harm than good, and in 1821 a union was effected, the resulting institution taking the name of the latter company with the interests and personnel of both. This long period saw the

establishment of several new trading posts on the river, and the abandonment of others. It is reckoned that in 1802 there were only two sites in use which are occupied at the present day: Red River (known as "Mikkwa") and Vermilion (known at that time as "Fort Liard") (100). The present Hudson Hope, though on the opposite side of the river from where it stands now, was established by Simon Fraser in 1805. Dunvegan was built in 1805—6 by A. N. McLeod and was for many years one of the most famous posts in the region not only because of its richness, but also because of its fine situation on a flat at the base of the picturesque grassy slopes which line the river in this neighborhood. In more recent years it has not stood up to its early promise, its place being taken in large part by such towns as Peace River Crossing, Pouce Coupé, Grande Prairie, and others which have sprung up in the interest of the newly developed agriculture. Fort St. John was probably established about 1808 (100).

Several journals covering portions of this period should be mentioned although they contribute little but descriptions of the usual river traverses. D. W. Harmon came to the Peace River in 1808 as a Northwest Company trader, spending two years at Dunvegan. Later he spent a series of years at posts west of the Rockies. He is best known for the excellence of his journal (30) which was kept meticulously, and which remains one of the finest accounts of life in the region at that time. Another journal contains the narrative of the journey of Sir George Simpson, the new governor of the combined trading companies, from Hudson Bay to the Pacific via the Peace River in 1828 (67). A third is that of John McLean, a trader who was for many years in the company's service both in the Mackenzie district and in New Caledonia. He has a brief account of his journey up the Peace in the autumn of 1833 (61).

#### 1872—1903

In 1872 a party in charge of Mr. Charles Horetsky, representing the Canadian Pacific Railway, was sent through the Rockies by way of the Peace River. In this party was John Macoun, pioneer Canadian botanist, who was then beginning the long series of collections and other field studies which later culminated in his Catalogue of Canadian Plants (59). The party went into the Peace River region by way of Lesser Slave Lake, leaving Edmonton during the first week of September. They crossed the

Pembina on September 6th and the Athabaska at Fort Assiniboine on the 8th; then continuing overland they reached the south shore of Lesser Slave Lake on the 20th. After following the south shore to a trading post at the western end, they travelled northwestward to the Peace River which they crossed on September 30th near the site of modern Peace River Crossing. The following day they arrived at Dunvegan. At this place they re-crossed the Peace and followed its south bank to a point opposite Fort St. John, where still another crossing was effected. On the 19th they left this place for Hudson Hope, Horetsky travelling overland and Macoun by canoe. Their journey over Rocky Mountain Portage and through Peace River Pass was uneventful and they arrived at McLeod Lake on October 5th. After crossing the height of land to Stewart Lake, Macoun proceeded to Victoria while Horetsky crossed northern British Columbia to the Skeena. Horetsky's narrative contains notes on topography and vegetation and is one of the first accounts of overland travel in the upper Peace basin. The earliest plant collections from the entire region were made by Macoun in the vicinity of Lesser Slave Lake and along the Peace, but the lateness of the season made them necessarily scanty (36, 54).

A colorful narrative of this period is that of Capt. W. F. Butler, an Englishman, who travelled up the Peace in 1873 (6).

The first scientific investigation of the Peace River was carried out by the Canadian Geological Survey in 1875, when Dr. Alfred R. C. Selwyn, then director of the Survey, led an expedition from Quesnell on the lower Fraser through central British Columbia, reaching the eastern boundary of the province by way of the Peace River Pass (91). John Macoun served as naturalist, and Arthur Webster surveyor to the expedition. They left Quesnell on June 5th, spent the 20th and 21st at Stewart Lake where they climbed "Stewart Lake Mountain", and arrived at Fort McLeod, on McLeod Lake, on the 28th. During the few days spent here Macoun collected assiduously in the vicinity, and on the 30th climbed a neighboring mountain which he called "McLeod Lake Mt.". On July 3rd the party left the lake, and on the 4th entered the Parsnip River. Finlay Forks was passed on July 9th, the 11th was devoted to climbing Mt. Selwyn, and the head of the canyon was reached on the 16th. The 13th was spent at Fossil Point, nearly opposite the mouth of the Clearwater River, where

Macoun climbed a limestone mountain on the north side of the Peace. The party left Hudson Hope on the 25th and the following day arrived at Fort St. John where a boat was built for a trip up the Pine River. Macoun left the others at Fort St. John for a journey down the Peace, while Selwyn, leaving this place on July 31st, spent a week on a journey up the Pine as far as Table Mountain. Upon his return to the Peace he visited Dunvegan and Smoky Forks, and made a short trip up Smoky River. Leaving the Forks August 23rd he returned to Quesnell and the coast by the route upon which he had come. While at Hudson Hope he made a short trip to Moberly Lake.

Macoun left Fort St. John on August 4th in the company of a Mr. King, trader, with the intention of going down the Peace until he should meet the Hudson's Bay Company boats bringing supplies upstream. He was to return with these boats and follow Selwyn's party to the coast, but owing to an unforeseen delay of the boats, he and King travelled all the way to Chipewyan without meeting them. Having started with only a limited supply of provisions they experienced considerable hardship before the end of the journey, and it was then so late in the season that Macoun did not attempt to return by the Peace River, but travelled up the Athabaska and Clearwater Rivers and thence eastward by the old Methye Portage trade route to the Saskatchewan and Lake Winnipeg.

A long list of plants accompanies Macoun's report of this journey, while the narrative itself contains a wealth of more or less precise information about the vegetation (56, 57). Unfortunately, however, it is possible to verify only a small portion of the records. The collections made at McLeod Lake, as well as those earlier in the trip, are preserved, evidently having been sent back to the coast from this point. They were necessarily small because of the earliness of the season (June). His collections on Mt. Selwyn were undoubtedly numerous as were also those along the Peace at least as far as Fort St. John, and there are several references to time spent in pressing plants in this interval; but these specimens were nearly all lost. A handful of material from Chipewyan represents the remainder of the journey through the Mackenzie basin. Macoun may be considered the first to see the opportunities for settlement and agriculture on the upper Peace.

One of the most discerning naturalists to visit the upper Peace was Dr. G. M. Dawson of the Canadian Geological Survey. In the course of a series of long journeys in British Columbia and adjacent regions he accumulated sufficient data for some excellent maps of the natural vegetation of which he was a keen student. His most extensive work in the Peace drainage was done in 1879 in the course of a journey from Port Simpson on the Pacific to Edmonton on the Saskatchewan (20). He arrived at McLeod Lake on the 14th of July and went down the Pack about the 17th. His party then crossed the Parsnip and with a pack train went up the valley of the Misinchinca River to Pine Pass which they reached about the 27th. Pine Pass had been first described only two years before by Joseph Hunter, surveying for the Canadian Pacific Railway (40). From this point they followed the banks of the Pine as far as the "lower forks", east of Table Mountain, then made their way overland in a north-easterly direction to the Peace River at Dunvegan which they reached about August 16th. About two weeks were then spent in a journey southward to Grande Prairie from which they went down the Wapiti and Smoky Rivers to the Peace. During the same period R. G. McConnell, a member of the party, made a reconnaissance trip northward from Dunvegan as far as Battle (Notikewin) River. The party left Dunvegan on September 5th, McConnell going with pack horses to Athabaska Landing, and Dawson to the Athabaska by way of Sturgeon Lake. The latter then descended the Athabaska to the Landing whence he went to Edmonton. Dawson's own narrative and description is supplemented with excerpts from the reports of McConnell and H. J. Cambie (7), the latter of whom was at work during the same season on a Canadian Pacific Railway Survey. Cambie travelled from Dunvegan to Hudson Hope overland by a route which kept about 15 miles north of the river. His description also covers a route from Hudson Hope to Pine River by way of Moberly Lake. A list of plants determined by John Macoun, and an essay on the distribution of forest trees in British Columbia appear as appendices to Dawson's report, but only a few of the actual specimens collected are now in existence.

In 1883 we find William Ogilvie, a surveyor in the employ of the Canadian Department of Interior, laying down township lines in the country west of Lesser Slave Lake and between this

point and Peace River. In the following year he surveyed the Athabaska River from Athabaska Landing to Chipewyan, and the Peace River up as far as Dunvegan. From Dunvegan he went back down the Peace, overland to Lesser Slave Lake, and so returned to Athabaska Landing. His meager reports (75, 76) of both these journeys are valuable for the many notes they contain on natural resources, especially of the future farming country along the Peace.

In 1887 G. M. Dawson made a difficult journey through parts of northern British Columbia and southern Yukon, chiefly for geological reconnaissance (22). His collections of plants are scanty but of considerable interest as being almost the only material available from the upper Liard River region. In addition to those noted in the list at the end of the present paper he collected many from the upper Yukon drainage, particularly along the Pelly River and on the Yukon (Lewes) between Fort Selkirk and Lake Lindeman. The party reached the mouth of the Stikine on May 18th and proceeded by steamer up this river to Telegraph Creek, whence they travelled overland to Dease Lake. In boats built at this place they started down the Dease River on June 18th, reaching the confluence of the Dease and Liard on the 23rd. R. G. McConnell left the party here and surveyed the lower Liard River, while the remainder ascended the Liard and Frances Rivers to Frances Lake which they reached on July 8th. From Frances Lake they accomplished the portage of their equipment to the upper Pelly River by July 29th, and arrived at the junction of this river with the Yukon on August 11th. Return to the coast was made via the Chilcoot Pass to the Lynn Canal which they reached on September 20th. As in his earlier report, Dawson published a map showing some of the principal vegetation boundaries in the region traversed, and in appendices he presented careful notes on the distribution of certain trees and shrubs, as well as a list of the plants collected.

The vast "inland" area between the lower Athabaska and Peace Rivers remained practically unknown until 1888 when the geologist R. G. McConnell made a rather thorough examination of it (52). His descriptions contain so many notes on the natural vegetation that it seems worthwhile to give his itinerary in some detail. The season was begun with a three week's canoe traverse between the Athabaska and the Peace by way of the

Pelican and Wabiskaw (Loon) Rivers. From the Peace several short trips were made inland, partly on foot and partly by canoe. One of these led eastward from a short distance above Battle River and followed part of the upper course of the Wolverine River. A trip of about 40 miles was made from Vermilion to the Buffalo Head Hills which lie to the southward. Red River, which enters the Peace about 5 miles below Vermilion Falls, was ascended approximately 100 miles (about 160 by the river). After an examination of Lesser Slave Lake a trip was made north-eastward to Whitefish, Bear, and Trout Lakes, and on the way back, a side trip westward to Loon Lake. This journey was accomplished with pack horses and canoes. From the Athabaska a trip was made on foot to Moose Lake on the Birch Mountains, outward by trail and back with canoes down Moose River.

Another report by William Ogilvie contains an account of a trip made by him in 1891 (77). On this occasion he went by way of the usual waterways to Fort Simpson on the Mackenzie, then up the Liard and Nelson Rivers to a point about in lat.  $57^{\circ} 31' 30''$ , long.  $122^{\circ} 43' 44''$ . From there he set out overland to Fort St. John on the Peace, reaching it after considerable difficulty. This report also is filled with notes on local conditions and appears to be the first published account of the country east of the mountains between the Peace and the upper Liard, a region still very imperfectly known.

Geological reconnaissance work on the northern headwaters of the Peace was carried out by R. G. McConnell in the field season of 1893 (53). The region was entered via Summit Lake and the Parsnip River, and Finlay Forks was reached early in July. After a hurried examination of the Peace River Pass, about nine weeks were devoted to the study of the Finlay and its tributaries, with journeys up the Omenica and some of its branches. The Finlay was explored as far up as the Fishing Lakes. McConnell's report contains, in addition to geologic and topographic information, notes on the general character of the timber.

A brief description of the Peace River between the Crossing and Lake Athabaska is to be found in the journal of the Indian Treaty Party of 1899, written by Charles Mair (69). The book acquires considerable biological interest because it includes Mr. Roderick MacFarlane's voluminous and valuable notes on the birds and mammals of the Mackenzie basin.

One of the most extensive and informative accounts of the upper Peace region east of the mountains is that of James M. Macoun who was sent by the Canadian Geological Survey in 1903 to investigate chiefly agricultural resources. His botanical collections, though not large in number of species, were carefully selected, for the most part in duplicate or triplicate, and distributed to the larger American herbaria so that they have been available for systematic and geographic studies. A brief description of his itinerary is as follows.<sup>1</sup>

Leaving Athabaska Landing on May 23rd he travelled by boat to the western end of Lesser Slave Lake which he reached on June 2nd. Mr. William Spreadborough accompanied him as assistant. On June 11th he left Peace River Crossing on a steamer, arriving at Vermilion on the 13th, and 12 days were occupied in examining the surrounding country. A few collections were made at Wolverine (Carcajou) Point but apparently none at Vermilion. After remaining at Peace River Crossing upon his return until July 5th he followed the Dunvegan trail to Old Wives Lake which was reached on July 9th. From there he made a circuit northward visiting Bear Lake (now Cardinal L.) July 10th, and White Mud River July 12—15, then took a trail southward toward Dunvegan, passing "McAllister Creek" July 16th, "Island Creek" July 17th, and "Little Burnt River" July 18—20. These localities are rather indefinitely located on recent maps. His McAllister Creek is probably a tributary of Hines River which is the name now given to what was then called Island Creek. His Little Burnt River may in this case be Boucher Creek, since Little Burnt River of recent maps is much farther east. The Island Lake mentioned in his journal is apparently not named on the later maps, while his Hay Lake is probably Lake George. A few days, July 21st to August 1st, were spent at Dunvegan, then the party crossed the Peace and spent a day in the vicinity of Spirit River (Aug. 2). From Spirit River they proceeded westward to the Pouce Coupé region, passing Rat (Ksituan) River on the 4th and Bear (Hamelin) Creek on the 6th. Three days, August 6th to 9th, were put in examining the Pouce

<sup>1</sup>J. M. Macoun's description of this journey was printed by the Canadian Geological Survey as Pt. E. of Annual Report xv pp. 1—48 (1904), but was never distributed. A very brief account of his trip is in the Can. Geol. Surv. Sum. Rept. for 1903, pp. 81A—83A (1904).

Coupé prairie, and then a southward course was taken to Swan Lake (Aug. 11), and a southeastward one to Saskatoon Lake which was passed on August 17th. A crossing of the upper part of Bear Creek was made on the 15th, and another, near Bear Lake, on the 19th, whence the party proceeded northeastward, examining the Grande Prairie district enroute. They then followed a wagon road northward to Spirit River where they spent a few days, August 22—7, before setting out for Lesser Slave Lake. They crossed Burnt (Saddle) River about August 28th, were in the vicinity of Egg Lake (probably Kakut L. of recent maps) from the 29th to the 31st, and crossed the Smoky River September 1st. Stinking (Winagami) Lake was passed on the 4th and Lesser Slave Lake reached on the 5th. Macoun maintained that the upland district would never become good wheat land unless hardier varieties of grain were produced which would ripen in a shorter time than those then in use.

#### 1903—1932.

Two journeys in 1911 and 1912 are of interest because of their excellent descriptions. In 1911 Hulbert Footner, a journalist, with a companion descended the Crooked, Pack, and Parsnip Rivers to the Peace (28). They climbed Mt. Selwyn enroute down the river, taking excellent photographs from its summit. They followed the Peace to Vermilion, from which they travelled overland by trail to Hay River which they descended to Alexandra Falls. Their return was by way of Vermilion, Peace River Crossing, Lesser Slave Lake and Athabaska River to Athabaska Landing. Footner's narrative contains notes on the general character of the vegetation north of Vermilion. In 1912 Frederick K. Vreeland, accompanied by W. F. Patterson, followed nearly the same route as did Footner to Hudson Hope (99). From there he took pack horses and went northwestward up the Halfway River to Cypress Creek which he ascended to Laurier Pass. The purpose of the trip was mainly to collect big game, but a good map is presented, with several notes on the timber.

With the exception of purely topographic and geologic ones which will be discussed elsewhere, the only recent expeditions which are of particular interest are those of the Pacific Great Eastern Railway survey, of Mrs. Mary G. (Mrs. J. Norman)

Henry, and of Mr. A. H. Brinkman.<sup>1</sup> Unfortunately the results of the first have not been published, nor are the plant collections, gathered by a geologist in the survey party, readily available for general study. In 1931 and 1932 Mrs. Henry collected plants in the mountains north of the Peace and on the southern tributaries of the Liard. A brief account of her first journey has been published (34), and through her kindness the writer has been supplied with the itinerary of her 1932 trip. In all she collected about 350 numbers of flowering plants and ferns, making many notable additions to the known flora of the region. Part of her material is in the herbarium of the Philadelphia Academy of Sciences, part at the Royal Botanic Garden at Edinburgh, and a few specimens of woody plants are at the Arnold Arboretum. Her itineraries in brief are as follows.

1931 (Nos. 1—180) — Left Fort St. John July 1st; rode north along Halfway River; arrived Redfern Lake July 14th; crossed Prophet River July 19th; crossed Musqua River July 23rd; crossed Howard River July 26th (lat.  $58^{\circ}$ , long.  $123^{\circ} 44'$ ); crossed Henry River July 30th (lat.  $58^{\circ}$ , long.  $123^{\circ} 56'$ ); crossed Norman River August 4th; saw Mt. Mary Henry August 5th (lat.  $58^{\circ} 35'$ , long.  $124^{\circ} 30'$ ); crossed Tetsa River August 6th; crossed Racing River at junction of Toad River and visited so-called Tropical Valley August 9th (lat.  $58^{\circ} 59' 7''$ , long.  $125^{\circ} 25'$ ); saw Mt. Gibson August 13th (lat.  $57^{\circ} 53'$ , long.  $124^{\circ} 25'$ ); visited Lake Mary August 19 (lat.  $58^{\circ} 24'$ , long.  $124^{\circ} 25'$ ); visited Lake Josephine, 1 mile W. of Lake Mary, August 20th; returned Hudson Hope September 17th.

1932 (Nos. 181—348) — Left mouth of Halfway River July 14th; went northwest along river; Pink Mountain, July 20th; Robb Lake, July 24th; Caribou Pass, opposite Mt. Kenny, July 26th; Redfern Lake, July 29th; glacier west of Redfern Lake, source of Besa River, August 1st; return via Redfern Lake;

<sup>1</sup>Most of the localities mentioned by Mrs. Henry are to be found on the following maps: National Topographic Series, Sheet no. 94 S.E. (Hudson Hope); and British Columbia, Sheet no. 94 B (Halfway River), Dept. of Int. Canada. A few places named by the Henry parties have not yet been entered on the maps. Mr. Brinkman's localities may be found on the Salteau and Giroux sheets (Sectional Maps, nos. 414 and 464, respectively).

A more complete description of her 1931 journey is soon to be published by Mrs. Henry in the National Horticultural Magazine, and will contain many excellent notes on the color, form, and local distribution of species mentioned in the catalogue.

Mt. McCusker, August 6th; upper Graham River, August 10th; Aylard Summit, August 14th; Hudson Hope, August 18th.

Mrs. Henry's party included, on both trips, Mr. K. F. McCusker of the Canadian Topographical Survey who mapped new territory and accurately located the routes. Names given to previously unrecorded landmarks have been accepted by the Survey and will be incorporated on future maps.<sup>1</sup>

Although not in the Peace River basin the botanical work of Mr. A. H. Brinkman in the Lesser Slave Lake district should be noted since many of his collections are listed in this paper. In 1928 and 1929 Brinkman was engaged in forest research work in the Lesser Slave Lake Forest Reserve, mainly east and south of the lake. His specimens, well put up and in considerable numbers, have been distributed to various herbaria. To save space in the list his collection localities have not been cited there since they are rather close both in time and space. Of the numbers cited, 3872—4086 (incl.) were collected between August 11th and 31st, 1928, mainly northeast and east of the lake; while numbers 4114a—4680 (incl.) were collected between May 30th and September 2nd, 1929. The 1929 records are approximately as follows.

May 30—31 (nos. 4114a—4139 incl.), Lake Mitsue and about the western end of Lesser Slave Lake; June 1—29 (nos. 4155—4305 incl.), near Salteau River, except no. 4295 which came from Otauwau Cabin; July 2—3 (nos. 4308—4339 incl.), Otauwau Cabin; July 8 (nos. 4345—4346 and no. 4671), near Slave Lake Town; July 9—August 7 (nos. 4348—4494 incl.), near Assineau River; August 9—September 2 (nos. 4497—4647 incl., and nos. 4678, 4680), near Martin River; September 1—2 (nos. 4648a—4652 incl., and no. 4658), near Slave Lake Town.

A small but interesting collection of plants was made in 1932 by W. G. Sheldon and Richard Borden on the headwaters of the Sukunka River, a tributary of the Pine. Several species are thereby added to the flora of the Peace basin. In 1931 Dr. E. H. Moss of the University of Alberta went by automobile through a considerable part of the Peace River agricultural district. His

<sup>1</sup>Since this paper was set up in type the writer has examined specimens collected in the same general region by Mrs. Henry in 1933. A few of these (11 species) make additions to the total flora, and have been inserted in the catalogue. They are there distinguished by the date "(1933)". They have not, however, been added to the lists in the earlier part of the paper.

collections, though not large, have also made notable additions to the list.

In recent years the National Research Council of Alberta has been forwarding soil surveys in the agricultural sections of the Peace River region (106, 107), and in a few isolated localities rather complete descriptions have been drawn up. Papers prepared by F. H. Kitto and published by the Natural Resources Intelligence Service of Canada (47) give excellent descriptions of the Peace farming country as well as good résumés of local geography. Good topographic maps are available for all of the river itself and much of the surrounding country (97).

#### NARRATIVE OF THE ARNOLD ARBORETUM EXPEDITION, 1932.

After a few busy days in Edmonton where the summer food supplies were purchased and packed, and where those inevitable last odds and ends of equipment were acquired, the party<sup>1</sup> boarded a train on June 6th for the Peace River country. The present end of the rails in northeastern British Columbia is at an enterprising town called Dawson Creek, in the midst of a beautiful farming community which reminds one very much of similar districts in the mid-western states. The comparison cannot extend to the horizon, for there the dark green points of the spruces and pines betray the prevalence of the subarctic and subalpine coniferous forests which replace our maples, oaks, and beeches.

It was necessary to remain in Dawson Creek until the 10th of June waiting for the freight to arrive from Edmonton, but comfortable quarters were found at a small hotel and the time was profitably spent with collecting and short journeys through the countryside. On the 8th we began our collections in the flats and meadows south of the town, and on the 9th went for a ride through the Rolla district north and northeast of Dawson. The freight was ready on the morning of the 10th, and by noon the entire outfit, with fuel, canoes, food, and personal duffel, was loaded on a motor truck. By evening we had it all safely unloaded on the bank of the Peace River opposite Taylor Flat where the camp life of the summer began in earnest. The first

<sup>1</sup>The field party included the writer's wife and son, and Dr. Ernst C. Abbe.

view of the river makes an indelible impression. For about 50 miles the road crosses the gently rolling surface of the plateau, with no hint of an approach to so ponderous a valley. True, we were partly prepared by the crossing of the Kiskatinaw with its steep canyon-like slopes, but at the Peace we looked across one of the master streams of the northwest, whose main course has probably been maintained since the last inland seas withdrew from the continent; whose channel was only temporarily encumbered by such mighty disturbances as the building of the Rocky Mountains and later by the advances of the Pleistocene glaciers. Its terraced valley slopes bear abundant evidence, but partially deciphered, of erosional and depositional cycles on a grand scale — of surface forming activity that has supplied the background against which we must project all of the modern life of the whole basin.

A day was given to the sorting of impedimenta and the establishment of routines for the new life we were beginning. The original plan for going up the river with a small outboard motor which we had brought along had to be abandoned; the high stage of water would have made the trip too slow, consuming precious time. Accordingly the local mailman was engaged to transport ourselves and outfit to Hudson Hope by a trip in between his regular weekly mail runs over the same route. The 12th was spent collecting in the vicinity of Taylor Flat, chiefly on the grassy bluffs of the north bank. On the morning of the 13th everything was loaded in the 40-foot launch, some supplies cached with Mr. McKnight, a local hotel keeper, for use on the downstream trip, and we began a two-day struggle against current and drift timber. The trip was easily accomplished in two days in spite of periodic wrestlings with an entangled propellor and much dodging about in search of slack water. The general aspect of the valley remains the same all the way up to a point about 7 miles below Hudson Hope where narrows called the "Gates of the Peace" are bounded by precipitous cliffs of limestone. Above the gates the river is somewhat swifter and the valley narrower.

Hudson Hope is beautifully situated upon a terrace about 100 feet above the river. A group of low rounded sandy hills rise back of the town, then the high bluffs which mark the edge of the adjacent plateau. There is good soil on the terrace and at

the base of the bluffs where a few settlers have farms and gardens. Like most settlements in the Canadian northwest, "The Hope" had its origin in a fur trade which still flourishes, though with diminishing returns. In more recent years there has been a sizable business in supplies, equipment, and guides for prospecting and hunting parties operating in the mountains to the westward. Situated as it is, just at the lower end of the impassable Rocky Mountain Canyon, and so at the head of navigation for boats connecting with the outside world by way of the lower Peace, its people have the business of carrying all goods over the 14-mile portage to the head of the canyon. There is a good wagon road on the portage, and although it is passable for automobiles, most of the freight is still hauled by teams. A road along the north bank of the Peace leads to Fort St. John but it is not easily travelled because of difficult stream-crossings.

We remained at Hudson Hope until July 4th, making collections on both sides of the river with notes on the local distribution of types of vegetation.<sup>1</sup> The manager of the Hudson's Bay Store, Mr. Russell, kindly gave us the use of a fenced-in meadow on the river bluff where we set up a comfortable camp. Although camping within the bounds of such northern settlements is not usually an agreeable pastime, this proved to be a welcome exception. The "neighbors" supplied us with fresh meat, milk and vegetables, as well as lore about the countryside. We soon made the acquaintance of Mr. J. L. Ruxton, a local chronicler with whom we struck a bargain for transportation and general assistance on the upper river. He brought with him not only a knowledge of the rapid waters but also a valuable and unfailing sense of humor,

<sup>1</sup>Botanical work at Hudson Hope:

- June 16— Trip to ravine in high bluff N.W. of the town.
- June 19— Route similar to that of the 16th, mainly for lichens and wood sections.
- June 20— Collections in pine woods N.E. of the town.
- June 21— Trip to high valley rim S. of the river, opposite the town, and along Maurice Cr.
- June 22— Collections from springy river bluff at the town, with Mr. Lloyd Gething as guide.
- June 23— Trip N. and N.E. of the town, to Lynx Cr. and the high bluffs.
- June 27— Trip to ravine visited June 16, and to upland sloughs south of it.
- June 28— Trip to high bluff S. of the river.
- June 29— Collections in vicinity of camp.
- June 30— Made soil sections in pine woods and prairies N. of the town.
- July 2— Further soil sections N. of the town.

in the face even of the perennial troubles rising from the notoriously temperamental outboard motor.

On the 4th Mr. Neil Gething with team and wagon took our luggage over the portage to the head of the canyon, while we followed on foot. A boat had to be prepared for the journey up river, and this, with a spell of rainy weather, kept us in camp for several days. The boat had been hauled up some weeks before, several hundred yards below the camp at the Gething cabin, so we laboriously brought it nearer our base of operations, calked it, and stripped its seams with lath which we ripped out and planed on the spot. On account of inclement weather these tasks and the final coat of paint took until the 8th. On the 6th, Abbe and Jim Ruxton went to the Gething coal mine several miles down the river in the canyon area, not returning until the following day. They brought back some excellent specimens which the writer supplemented on the 7th with a few from the upper end of the gorge.

By the 9th everything was in readiness and we got away up the river about mid-morning. The boat was a flat-bottomed affair, 36 feet long, very deep and short of beam. Its narrow bottom and slightly flaring sides made it somewhat tipsy, but after we became accustomed to its vagaries it proved quite a worthy craft. Most of the river boats in these parts are built on much the same plan but with more flaring sides, and are driven by inboard or outboard engines developing 8—20 horsepower. They are the product of years of experience with the rapid currents and heavy freighting requirements.

The journey to the mouth of the Wicked River, a distance of about 70 miles, was accomplished in three easy days. At the end of the first day camp was made at the mouth of Carbon River where we enjoyed the hospitality of Mr. Charlie Jones and his good wife who have established a delightful home in this little-frequented place. Not the least of our treats was a supply of goat's milk from their herd. From a few miles below Carbon River we had our first view of the high mountains in the main ranges of the Rockies. The country through which we passed on the 9th and the morning of the 10th may be classed as a foothill region. For about 30 miles above the canyon a sharp contrast is maintained between the heavily timbered northward-facing slopes and the grassy southward-facing ones. The contrast is

less and less marked above Carbon River, while in the vicinity of Mt. Selwyn, in the pass itself, both valley slopes are more or less heavily timbered. At the end of the second day we made camp above the Ne Parle Pas Rapids which we passed, fortunately, without having to put out a line. This is by no means a dangerous rapid, but the commonly used channel on the north side is complicated by a powerful eddy current about mid-way, and tracking is difficult at high water because of precarious footing on shore.

Camp was established at the mouth of the Wicked River, a rushing mountain torrent which enters the Peace just across from Mt. Selwyn, the objective of the expedition in this region. Peace River Pass is here quite narrow, and is very near the western slopes of the Rockies. The Wicked is about 10 miles below the beginning of the Peace at the confluence of the Finlay and Parsnip Rivers. This camp was occupied until August 1st, and used as a base of operations on both sides of the river. It proved to be an excellent place for the purpose, with a delightful climate, and remarkably free, for this year at least, from the mosquito and fly pest which plagues so much of the subarctic wilderness. The Wicked yielded up excellent trout to Jim's efforts with hook and line, and we fared royally. There was no dearth of visitors, for the Peace is a highway for the motley assortment of prospectors and miners who manage each year to wash a little gold from its bars. On the 15th two young men appeared who introduced themselves as Richard Borden of Harvard and William G. Sheldon of Yale. They had come down through the Parsnip River country enroute to Hudson Hope, whence they would later be off to the ranges south of the Peace in search of mountain sheep. They stayed with us a couple of days and told interesting tales of a trip of the preceding year in the mountains north of the river.

Several trips were made on Mt. Selwyn, three of them to the peak, while a series of shorter excursions brought in representative material from the lower country.<sup>1</sup> The mountain rises directly from the river, and is one of a group of peaks whose summits are

<sup>1</sup>Botanical collecting in the vicinity of Mt. Selwyn:

July 13— Trip to summit and western slope of Selwyn.

July 14— Collections from valley of Wicked R. chiefly near the falls, about  $3\frac{1}{2}$  miles above the mouth.

July 16— Collections near camp.

July 18— Trip in thick timber on eastern valley slope of Wicked R.

about 7000 feet above the sea, or about 5000 feet above the river. It has precipitous cliffs on its north and east sides, but on the west and southwest are gradual slopes which make the ascent comparatively easy.

We were favored with good weather during most of this period. In general it was cool with brisk westerly winds, with very little of the depressing humidity so common on the lower Peace. Our plants dried in a few hours when the presses were heated over small gasoline stoves carried for the purpose. Experience shows that some sort of artificial heat is essential for drying specimens in the subarctic regions if long and costly delays are to be avoided. We have found that the best press for the purpose is one of corrugated boards having smooth faces on both sides, and the surface paper partially glazed. No blotters are used, and the boards are so arranged that the corrugations are vertical, thus allowing an upward passage of heat through them. The presses are usually supported about 30 inches above the ground, on a rough frame of stakes and poles which may be made, if necessary, without nails and with no other tool than an axe. A piece of canvas is usually used to completely cover the sides and ends of the frame so that all of the heat goes up through the presses. "Primus" stoves which burn gasoline or kerosene by a vaporizing process give an intense heat, are economical of fuel, and may be packed into a very small space when not in use. Since corrugated boards are bulky when carried in large numbers, we have made a practice of taking only 150—200 of them, and using a quantity of standard driers for temporary storage of newly pressed specimens. As soon as one lot has been dried in the boards it is removed and another inserted.

The original plan had been to leave the upper river about the

- July 19— Trip to summit and western slope of Mt. Selwyn.
- July 20— Few specimens from banks of the Wicked.
- July 21— Collections from woods at N.W. base of Mt. Selwyn and from banks of the Peace near Quartz Cr.
- July 22— Trip to flood plain slough area along the Peace about 6 miles below the Wicked.
- July 23— Trip to summit of Mt. Selwyn.
- July 26— Trip to small lake on W. slope of Mt. Selwyn, alt. about 5000 ft.
- July 29— Collections from woods and river bank at mouth of Quartz Cr.
- July 30— Soil section in rich woods along Wicked R. about a mile above its mouth, and a few specimens from the vicinity.
- July 31— Miscellaneous collections from vicinity of camp.

While in this region a few specimens were given to us by a Mr. Robbins, a mining assayer working on Mt. Selwyn. They came chiefly from the northwest slope.

middle of July, but the collecting proved so luring that we had additional supplies sent up and so could put off our departure until August 1st. The downstream trip was accomplished without mishap. After camping on the night of the 1st at Carbon River, we went next morning, with horses obtained from Mr. Jones, up Carbon River about 4 miles to find a muskeg which lies on the east side and just above this stream. We had found no muskegs in the vicinity of Mt. Selwyn, so were anxious to add to our collections such plants as are peculiar to this type of habitat. Late in the afternoon of the 2nd we again got under way and reached the portage at dark. Next day was devoted to pressing plants and collecting at the base of the Butler Ridge some 3 or 4 miles northwest of the Gething cabin. An old prospector, Joe McNamee, had seen some slough ponds in that area to which he took us with profitable results.

Everything was safely over the portage by the evening of the 4th. The 5th was given to sorting and preparation for the long journey to Lake Athabaska. Jim and his motor were taken on for the remainder of the summer, and we made the distance to Taylor Flat by late evening of the 6th. Here the collections made thus far were securely boxed and sent to Edmonton via Dawson Creek, the larder restocked, and everything packed in the canoes — we had stored our canoes at Taylor and Hudson Hope during June and July. The bulk went into the large one — a 20-foot freight — while a smaller craft, towed along behind, carried its share. A time-consuming task on a trip of this sort is the sorting of food supplies. We have found it highly worth while to have our grub packed, before leaving Edmonton, in two-week lots, each of which is calculated to carry the whole party for that length of time. The lots are in separate stout boxes suitable for shipping, and are carried intact until needed. This arrangement saves much time in the field, and is not costly since the goods have to be packed anyway. Furthermore, the boxes may be shipped easily to convenient points where they may be picked up by the field party.

About noon on the 8th we left Taylor, and were at Peace River Crossing at noon on the 10th. During the afternoon of the latter and the morning of the 11th additional supplies of food and fuel were laid in, another box of specimens, still damp at Taylor, was shipped to Edmonton, and the canoes repacked with their cum-

bersome loads. Between Peace River and Vermilion Chutes only two stops were made for anything other than overnight camps. The weather since the first of the month had been so hot and sultry that we welcomed the slight breeze which came from the motion of the boats. A haze of forest-fire smoke overhung the whole landscape, rendering photography almost impossible during this part of the trip and, incidentally, reducing the spirits of the whole party to lowest ebb. But on the 12th there came one of the heaviest rain and hail storms we have ever experienced, which finally drove us ashore for it became impossible to see ahead. Tarps and raincoats kept most of the water out of the canoe, and but little time was lost. The following day turned out to be so wet that we remained in camp. Low-hung clouds raced down from the north all day, with continuous rain or threat of it.

A curious incident of the 12th was the passing of a timber wolf as it was swimming the river a short distance above the mouth of the Notikewin. We circled quite close so that we got a good look at it, and some photographs. Wolves are rarely seen, winter or summer. In six summer seasons of almost continuous living in this wilderness we have seen them only once before when three were come upon by surprise as they lay in the open woods along the Little Buffalo River near the Ninisheth Hills. Of other wild life there seemed an abundance. The moose habitually crossed the Peace just above the mouth of the Wicked, within sight of our camp, and deer came between our tents and the water's edge. Although there were abundant signs of bear in the mountains we were not rewarded with actual sight of them. Mountain sheep were seen on the north bank of the Peace a short distance below Carbon River. Farther down stream occasional black bears were feeding on the open valley slopes as we glided past.

The 14th threatened more storm but we started out again in spite of it, which proved fortunate since the weather had cleared by afternoon. It had been planned to stop for collections at several places on this part of the river but the time had grown so short that if we did not keep going there would be little opportunity for a trip on Lake Athabaska. The 15th, however, was utilized for collecting on the northern bluffs about 10 miles above the Carcajou Indian Settlement. On the evening of the 16th, about 30 miles above Prairie Point, we had our first view of the distant Buffalo Head Hills east of the river.

Vermilion is a delightful frontier settlement at which we would gladly have lingered had there been time. It is the center of an agricultural district of remarkable richness for so high a latitude, and has a government experimental farm of long standing. The small canoe had materially retarded our progress, so we determined to be rid of it if possible. An amusing incident of the transaction occurred when an Indian came to bargain. One of the party facetiously dubbed him "Lo the Poor Indian", and as we could not understand his right name this appellation served for discussion among ourselves. Imagine our open-mouthed surprise, therefore, when he produced a huge roll of bills from which to pay the paltry sum which we had with some diffidence requested.

The 4½-mile portage at Vermilion Chutes was accomplished without mishap on the 20th. An affair of the preceding day served to enliven the otherwise monotonous hours in the cramped quarters of the canoe. A water-logged bit of driftwood had broken a propellor shear pin, and while it was being fixed a can of heavy black oil such as is commonly used in gear-cases was upset in the stern. The spreading and smearing propensities of this oil were so great that in no time at all everything and everybody in that end of the canoe had a share of it. While waiting next morning for the team to come up from Red River for the load, we managed to get most of the mess out by copious applications of warm suds to the whole inner surface of the boat.

On the 21st we crossed the surveyed line of the fifth meridian and entered that part of the Peace River which flows through the Wood Buffalo Park, and with which we were familiar from earlier trips. Peace Point, the scene of collecting in 1928 and 1930, held us for a day, the 23rd, while we examined the surrounding prairies, dug some holes for soil sections, and stalked a herd of buffalo lurking in the timber along the river. Wishing to make some collections in the Athabaska-Peace delta we turned from the Quatre Fourches Channel into Lake Mamawi and paid a visit to the Government "Dog Camp" on the east shore. Here we partook of the genuine hospitality of Warden D'Arcy Arden and his delightful family who have the summer care of the dog teams used in the park organization. With the Ardens and Warden Frank Dent, with whom we had spent many pleasant days in the park, we swapped "yarns" for a day or two while we gathered

specimens in the vicinity. In the evening of the 26th came Mr. J. D. Soper, well-known for his study of the Blue Goose in Baffinland, and now stationed in the Wood Buffalo Park.

Next day we started about mid-morning, and after a short delay at Chipewyan for supplies, continued eastward on the north shore of Lake Athabaska. Darkness fell before a good camp site was located, and we came unpleasantly near wrecking the canoe on a hidden rock; but a sandy beach at Shelter Point was finally found, and the canoe had to be unloaded by fire-light. The next two days were given to pressing plants and collecting in this vicinity, previously studied in 1926. The chief objective of the trip on the lake was to supplement the 1926 material, and especially to visit an area on the north shore where rocks of early pre-Cambrian age (Tazin Series) outcrop. To this end we moved camp to a place just east of Sand Point where we stayed from August 31st to September 9th.<sup>1</sup> The weather became so stormy during this period that it was essential to leave in plenty of time if we were to catch the boat at Chipewyan on the 12th. So on the first reasonably calm day after the 7th, the date we had arbitrarily set, we packed up and started about mid-morning; but upon rounding the point we found the wind blowing briskly from the southwest, piling up waves of increasingly formidable height. With the canoe so heavily laden it was useless to try to make headway, so we made for the shore. Fortunately a sand beach was available, otherwise we would certainly have injured the canoe when we tried to land in the surf. The lake calmed during the night, allowing a safe journey to Chipewyan early the following morning. And we arrived none too soon, for a series of gales on the following days would have kept us off the lake entirely.

Delay in the steamer's schedule kept us at Chipewyan until

<sup>1</sup>Botanical work in the vicinity of Sand Point:

- Sept. 1— Trip over hills and muskegs N. and N.E. about 4 miles from base of Sand Pt., returning along shore.
- Sept. 4— Trip over the basal two-thirds of Sand Pt.
- Sept. 5— Trip through hill and lake country about 3 miles N.W. of camp.
- Sept. 6— Trip by canoe to outcrop of sandstone rocks on shore about 4 miles N.E. of base of Sand Pt.
- Sept. 7— Collections from about the middle of Sand Pt.
- Sept. 8— Few specimens from outer half of Sand Pt.

Miscellaneous collections from the vicinity of camp were made on Aug. 31, Sept. 6, and Sept. 7. A few came from the lake shore a short distance S.W. of Sand Pt. where we camped on the evening of Sept. 9.

the 14th but the stay was welcomed because it gave us an opportunity to dispose of part of the outfit, make a few collections, and renew our acquaintance with the good people of the village. Mr. Loutit, the Hudson's Bay Company manager, kindly placed at our disposal a comfortable house, and we were delightfully entertained at the home of Corporal Bryant of the Mounted Police.

The journey southward by the Athabasca River to McMurray was uneventful, and we finally arrived in Edmonton by the weekly train from Waterways on September 17th.

## GEOLOGY AND PHYSIOGRAPHY PRE-GLACIAL GEOLOGY

Although the origin and distribution of the present plant cover in the Peace River region have their closest relationship, geologically speaking, to the more recently formed topography and soils, a preliminary consideration of earlier geologic history is essential because the major land forms, as defined by these more ancient processes, give primary character to the modern arrangement. The broad central plain across which the river flows in its course between the mountains and the Slave has both its climate and vegetation greatly influenced by the presence of the western mountains. Eastward, the vegetation of the plain shows major changes at the margin of the crystalline rocks, an area which has been a prominent geologic boundary since the Paleozoic. Furthermore, the erosional features of the plain itself, having had their beginning in the latter part of the Cretaceous, have determined very largely the manner in which the present surface soils and their modifications have come about. The following is a brief summary of the strata seen in the valley of the river, beginning with those at its mouth.<sup>1</sup>

Notable features of the delta lowlands of the Peace and Athabasca Rivers are the rounded granite hills which rise either as islands from the shallow water or as isolated knolls in the mud and drift deposits. These hills, outliers of the pre-Cambrian rocks which reach eastward to Hudson Bay, are usually scoured

<sup>1</sup>The writer is indebted to Professor Kirtley F. Mather for criticising the following treatment of the general geology of the region. Professor Kirk Bryan, also of the Department of Geology at Harvard, has given some valued suggestions regarding physiographic problems.

and grooved by glacial action and contain only small patches of soils which in this particular area often have a clayey character. Such clayey soils do not seem to occur much farther east. The positions of the hills with respect to the channels of the sediment-bearing streams have determined in large measure the configuration of the delta lands, as described elsewhere by the writer (85). Westward the hills are lower, and entirely disappear beyond Lake Mamawi and Rocky Point (on the Peace River about 2 miles above the Quatre Fourches). They are commonly observed along the upper Slave River, and a group of them, representing a prominent western extension of the pre-Cambrian, cause the unnavigable Smith Rapids in this stream.

With the exception of these knolls the only modifications of the lowland banks of the Peace below the vicinity of Peace Point are sandy ridges, apparently of morainic origin, through which the river has cut its channel. Between Peace Point and Vermilion Chutes there are outcrops of Paleozoic rocks in beds locally folded and broken but horizontal in general aspect. From Peace Point to the Jackfish River the rocks are gypsiferous Silurian limestones (13), but above this point there are Middle and Upper Devonian limestones. The latter form the "Chutes" below Vermilion where the river has a total fall of 25 feet. Later Paleozoic sediments are entirely absent from the Peace River valley as they are from nearly all of the Mackenzie basin. So far as is known the Cretaceous directly overlies the Devonian everywhere except in the mountains where Triassic beds are found.

From Vermilion Chutes to the mountains the river's course is entirely through Cretaceous rocks which outcrop all along its banks. The successive formations have been described by F. H. McLearn (62, 63), and are readily available in the reports of the Canadian Geological Survey. The rocks of the Rocky Mountain Canyon area are also of Cretaceous age and contain an excellent grade of coal (65).

Recent studies in the Peace Pass, made in connection with the railway survey, will undoubtedly throw new light upon its geologic history, but the results of these are as yet unpublished. General descriptions of the area written by Selwyn in 1875 (91) and McConnell in 1893 (53) will be used here to summarize the situation. Between the canyon and a point about 5 miles below the mouth of the Clearwater River the outcropping rocks of the

foothills are largely of Cretaceous age, composed of calcareous sandstones and shales variously tilted and faulted. In this area also McLearn notes Triassic rocks composed of "dark purple limestones, hardened sandstones, and shales" (62). They outcrop at the Ne Parle Pas Rapids and about 2 miles below the mouth of the Ottertail River. Other, probably Lower, Triassic beds are exposed at Twentymile Creek. At the western edge of the Mesozoic exposures, according to McConnell, as elsewhere along the eastern boundary of the range, the Paleozoic limestones of the mountains are thrust over the more recent Mesozoic beds. The rocks of the mountains are often steeply inclined and are extensively faulted and crushed. Quoting McConnell, "Mount Selwyn shows a sharp anticline on its eastern slope. The center of the mountain is formed of almost vertical limestone beds, but going westward these are soon replaced by the quartzites, schists and crushed conglomerates of the Bow River series. The latter are forced up over the limestones by a well-defined overthrust fault, running in a northwesterly direction. Mount Selwyn is flanked on the west by a small range composed partly of the rocks of the Bow River series, all dipping to the southwest. The latter overlie the former, but the cause of their superior position was not ascertained".

The surface distribution of underlying strata in the Peace River region has been studied in detail only in a few places such as the more settled sections. Most of the country is covered with a mantle of Glacial or post-Glacial deposits which make any such investigation very difficult. North of Peace Point the abundance of sink holes with accompanying phenomena of underground drainage indicates a considerable extension, near the surface, of the gypsiferous Silurian deposits. The erosion plateaus of the Birch and Caribou Mountains, the Buffalo Head Hills, and other similar uplands are all known to be underlain by Cretaceous rocks whose affinities have not yet been determined. Rutherford's excellent studies in the Peace River agricultural district (87), made in connection with water supply investigations, make a notable contribution in this direction.

Before treating the more recent history of the present surface it will be well to summarize the foregoing notes. At the beginning of Pleistocene time there must have existed a relatively mature topography throughout the Peace River basin east of the moun-

tains, resulting from a period of erosion extending from late Cretaceous throughout most or all of the Tertiary. "The general result of this erosion was to produce a surface of gentle slopes extending from the upland to the base of the stream valleys. The stream valleys were not entrenched to their present depth, so that apparently the relief at the close of this period was not so marked as at present" (87). Furthermore, the erosion in the lower Peace region was so complete as to have entirely removed the Cretaceous deposits, exposing the older Devonian and Silurian sediments, while in the lower Mackenzie basin even the Cambrian was deeply dissected (38, 103). Due largely to the arrangement of strata with thick shale members separated by harder beds such as sandstones, the heights of land between the main drainage streams have been left as erosion plateaus capped with the harder rocks. Hume (39) shows that in parts of the Mackenzie valley the early denudation of the Cretaceous was such that it was entirely removed prior to the beginning of the Tertiary, since Eocene deposits have been found near Norman resting directly upon the Devonian. It will be seen therefore that the primary form of the Peace River valley probably dates, at least in its lower sections, from late Cretaceous, and that it has not been greatly modified since, even by the Pleistocene.

The western portions of the great Paleozoic and Mesozoic seas were characterized by thick deposits of sediments in what has been called the Rocky Mountain Geosyncline. The materials evidently came from land masses farther west, the erosional history of which is obscure. The close of the Mesozoic saw the elevation and faulting of these thick deposits to form the present Rocky Mountain system, later somewhat modified, by the close of the Eocene, to form the main features of the topography as we know it. S. J. Schofield has given a résumé of the probable conditions in these periods (89). From his notes it appears that the upper, British Columbia, portion of the Peace River was a prominent eastward-flowing stream throughout the Cretaceous; and that it was able to maintain its general course not only through the mountain building of late Cretaceous time, but also through most of the Eocene when the more recent overthrust beds of the eastern front of the Rockies were uplifted. It was this vigorous stream which began, in late Cretaceous or early Tertiary, carving out the bold modern features of its present basin, and was

probably then as it is now the main contributor to the waters of the Mackenzie system.

### GLACIAL GEOLOGY AND PHYSIOGRAPHY

Nearly all of the land surfaces in the region are covered to varying depths with unconsolidated materials which originated in Glacial or post-Glacial time. The manner in which the deposits were made, however, is far from clear. Nearly all of the geological investigators working on the problem have made notes on the recent beds, but only occasional attempts have been made to correlate them. Of these, G. M. Dawson's papers on the Pleistocene of the Cordilleran and Great Plains areas (18, 19, 21, 23), and A. E. Cameron's studies in the central Mackenzie basin (10) are the most important for present purposes. More recently, Rutherford's notes on the country about Dunvegan and southward are of particular interest (87).

It is now generally accepted that the ice sheet which originated in the Keewatin district west of Hudson Bay at some time during the Glacial Period reached nearly or quite to the base of the Rocky Mountains, depositing, as it melted, its load of detritus. This material forms the thick beds of boulder clay which underlie nearly all of the northern Great Plains, and sections of which are so commonly seen on the bluffs of streams. The findings of McConnell (52) and later of Rutherford (87) are in agreement with earlier descriptions by G. M. Dawson (21) who recognized the wide extent and remarkable uniformity of the deposits. The materials show that they have all come from the granitic region west and southwest of Hudson Bay. All of the higher plateaus do not appear to have been covered by the ice. J. A. Allan could find no evidence of glaciation on the tops of the Swan Hills (1), and the present writer, in 1930, found soils on the eastern edge of the Caribou Mountain plateau which appeared to have been weathered *in situ* out of the underlying rocks, thus indicating a lack of any scouring by the ice. The western extent of the boulder clays is not definitely known. Coming into the Peace River by way of Pine Pass, Dawson first found Laurentian boulders at the D'Echafaud (Pouce Coupé) River, about 75 miles east of the mountains.

It is thought that the Cordilleran ice advances preceded the Keewatin in most of the country, but Keele found Keewatin

Pleistocene materials overlying the Cordilleran in the valley of Gravel River, a western tributary of the Mackenzie (44). The Cordilleran ice sheet appears to have originated west of the Rocky Mountains, and to have been obstructed by the latter in its eastern advance (23) so that its effect upon the eastern plains was minimal. Tongues of ice evidently passed through the mountains leaving moraines in places some miles east of the front ranges, and temporarily, at least, modifying normal drainage. It is probable that the melting of such an ice mass in the Peace River valley deposited moraines in the Hudson Hope district which effectively dammed the river for a time, possibly forming lakes in the pass and foot hills to the west. McLearn pointed out that there are two outlets for the river as it leaves the foothills, one on either side of Bullhead Mountain, and that the one on the north side is entirely dammed by morainic materials causing the river to take a circuitous course around the south flank of the mountain where it flows in its present canyon (62).

There are sandy morainic ridges just north of the town of Hudson Hope which are obviously of western origin. They have a lobate form, extending from a narrow ridge area at the base of the plateau northwest of the town, eastward and north-eastward where they gradually spread out as a series of ridges over a territory some miles wide. These moraines lie on a plain about 1600—1700 feet above sea-level, so that they could not have been affected by any ice advance from the east over the adjacent high plateau (2000—2300 ft.).

Finer materials composed of sands and silts cover the boulder clays over vast areas in the Peace and Athabaska River basins. Throughout the history of the investigation of them there has been a persistent tendency to regard them as of glacio-lacustrine origin, dating from the final retreat of the last ice. R. G. McConnell, describing the lower Athabaska (52), says, "The stratified sands and gravels both below and above the boulder clay in the lower part of the Athabaska valley, are evidently lacustrine in origin and were doubtless deposited along the southern margin of the greatly extended Lake Athabaska of the Glacial Period". G. M. Dawson maintained for many years that all of the drift, both boulder clay and finer stratified materials were due to submergence on a large scale during the Pleistocene, involving a great body of water, probably brackish, upon which floated ice-

bergs from both Keewatin and Cordilleran glaciers. These icebergs would serve as rafts which upon melting would deposit their loads of glacial debris. In 1918 J. A. Allan described lacustrine soils about the base of the Swan Hills (1).

A. E. Cameron has outlined the probable sequence of events in the lower Peace and central lake region of the Mackenzie basin (9, 10, 83). This work, based upon its author's extensive field studies, has been cited in some detail by the present writer in papers dealing with flora of the lake region; consequently only that part which pertains to the Peace River drainage will be discussed. Morainic deposits indicate that as the Keewatin ice retreated there were well-defined lobes extending into the lower valleys of the Athabaska, Wabiskaw, Peace, Hay, and Buffalo Rivers, and another into the upper valley of the Mackenzie which was probably so dammed that it no longer served as a drainage outlet. The waters draining from the mountains and plains, impounded into vast glacial lakes by this ice, probably found an outlet for the time being southeastward into the Churchill River valley. The lakes, or expansions of the same lake, developed typical shorelines at their margins and silt deposits on their bottoms. With the further retreat of the ice to the northeast the lakes were modified in shape, size, and level at intervals, so that in such a valley as the Peace there is a series of plain levels marking the lake bottoms left exposed at the successive withdrawals of the ice dams and the establishment of more normal drainage.

Cameron's description of the Peace valley from this standpoint is excellent. He points out that the plateau level above Peace River Crossing is one of great uniformity throughout this part of the Mackenzie basin, extending far to the southward and southwestward as a more or less continuous plain with an elevation usually ranging between 2250 and 2700 feet. Northeastward it is represented by the isolated erosion plateaus already described. "On descending the river below the town, the valley walls contract to gorgelike proportions, and the apparent crest of the valley gradually lowers. Ascending to the crest at a point some 50 miles below Peace River, one would find himself on another plain level at a lower elevation than that above Peace River town.

"The plain is narrowed to a width of about 50 miles, but is distinctly flat. It is bordered on the east by the shoulder of Buffalo Head Hills, and on the west by a southerly extension of

the Watt Mountain Plateau. The elevation of this plain is about 1600 feet.

"Descending the river still farther to a point near Battle River and there scaling the immediate valley walls, another plain level confronts the eye on reaching the top, this time at an elevation of 1100 feet. East and west of the river this plain stretches some thirty to forty miles before rising gradually to a comparatively narrow bench land at an elevation of about 1600 feet which must be crossed before ascent can be made to the old, original plain level.

"About 50 miles above Vermilion the Peace River swings rapidly eastward and, the valley walls receding, it enters a widely extended plain area at an elevation of about 800 feet which, at Vermilion, stands scarcely more than 30 feet above water level. This plain level is practically continuous with the basin of Athabasca Lake and extends northward around the foot of Caribou Mountain Plateau to the basin of Great Slave Lake".

The present writer's observations on the lower of these plains are to be found elsewhere (83, 85). The 1100-foot level has been found to have a development at the eastern base of the Caribou Mountains, while the 800-foot one has been correlated with the small plain at Peace Point and the larger expanse of the Salt Plain west of the upper Slave River. Evidences of equivalent plains were found by Cameron in the valleys of the other rivers above mentioned.

Above Peace River Crossing the details of the lacustrine deposits have not yet been worked out to this extent. Rutherford, in describing the Pleistocene geology of his map area (87), says, "The second type of glacial deposits, namely the semi-stratified silts and clays, is a pronounced feature especially in the flat areas bordering the deep valleys of the main streams. These have been interpreted as glacio-lacustrine deposits, because of their lateral continuity and relatively level surface. In the discussion on physiography, three divisions of physical features were made, namely, the uplands, the bordering relatively flat areas, and the deep river valleys. It is probable that prior to glaciation the slope from the main river level to the upland was more regular than at present, and the surface contour at such a time would not have shown such a marked three-fold division of physical features. Two causes have contributed to this change of surface, namely, a

filling of the depressions with glacial lake deposits and a subsequent development of deeper river valleys. 'The filling was composed largely of muds and fine silts, in part of glacial origin, but also derived in part from erosion of the relatively soft shale formations occurring at the surface. This fine material was apparently deposited in long lakes occupying the valleys or depressions, the lakes being due to damming during the ice retreat. These water bodies, although probably fluctuating in level as the ice barrier gradually withdrew, were of sufficient duration to permit the accumulation of upwards of 200 feet in places of fine textured muds". It should be noted that the elevation of these deposits averages above 2000 feet, which involves a lake level, or levels, considerably higher than those noted by Cameron farther down stream.

Recent maps of the Peace west of the British Columbia boundary show terraces at several places in the valley such as at Taylor Flat and Hudson Hope. These all stand at or near the 1600-foot contour line, which would correlate them with Cameron's 1600-foot level below Peace River Crossing. They were found by the present writer to contain clayey soils similar to those farther down, and probably represent local expansions of the same lake which formed the latter.

#### SUMMARY

Plants migrating into the Peace River basin during the later stages of the Pleistocene probably found the first land surfaces available on the upland erosion plateaus such as the Saddle, Birch, and Buffalo Head Hills, the Watt, Caribou, and Birch Mountains. In most cases the soils were of boulder clay with some sorted materials, but it is possible that on a few of the higher lands like the Caribou Mountains, which may never have been covered with ice, at least in the latest period of glaciation, there were still older soils formed from the underlying rocks. The retreat of the ice did not immediately expose the intervening ground, but kept it under lakes for a long period during which finer soils were laid down over large areas. Successive stages in the retreat did not expose these soils all at once, but generally in the order of their decreasing elevation, until the final and youngest are only a little higher than the present lowlands of Lakes Athabaska, Mamawi, and Claire. There were still further com-

plications in the sequence, at least at the lower levels, when parts of these lakes were probably held back by moraines in restricted areas until their drainage streams could make their way through the barriers.

The new drainage set up on the higher parts of the lacustrine deposits must have been good from its inception, so that, given sufficient precipitation, a comparatively well-watered and well-drained soil of loamy character was available to plants from the start. In some places there was evidently some ponding or even the retention of large lakes which persist to the present. Most of the lakes and ponds of the region were of this origin, including Lesser Slave Lake, around which the raised beaches attest its former size.

During the time when the uplands were exposed and the post-Glacial lakes still remained there were undoubtedly minor elevations which stood out at intervals, representing the tops of morainic deposits left by the retreating ice. These have been fairly well defined in the region north of Peace Point, but on the upper Peace their positions are not well known. Rutherford designates a few in his map area (87). The soils thus made available were probably boulder clays intermingled with partially sorted sands and gravels. East and southeast of the Caribou Mountains they are composed largely of sand.

The present Peace River has cut its way through all of the unconsolidated materials, maintaining its pre-Glacial course except in a few cases where these materials have forced it into new channels. What was probably a great falls in the canyon area after the Pleistocene has been reduced to a tumble of rapids and minor drops. Vast quantities of detritus have been carried to the lower river where the channel meanders in broad lowlands all the way from below Carcassou to Lake Athabaska. Its delta-building activities in the latter place have already been described. But not all of its load has been left there; a large post-Glacial southern arm of Great Slave Lake was in large part also filled with deposits from the Peace.

### CLIMATE

Meteorological data have been accumulated at several points in the drainage basin of the Peace River, but at no point do we have a continuous record over a long period. Even at posts

where notes have been kept for twenty or thirty years there are interruptions of one or more years which serve to break the sequence. It is, accordingly, difficult to find a continuous record for even a short period in which there are simultaneous readings at several points representing different natural divisions of the country. Such simultaneous records seem essential to a correlation of climatic events with the distribution of plant life. Beside the regular weather records the only other important source of information is in the narratives of travellers, which, although they are usually quite random, often contain valuable notes on isolated local conditions, particularly with regard to frost and drought.<sup>1</sup>

In any interpretation of the climate of this area as related to the arrangement of natural vegetation it must be borne in mind that nearly all available discussions of the climatic factors are concerned with agricultural possibilities of one sort or another. In fact a large portion of the data itself has been collected from this standpoint. There is much in common, of course, in the two points of view, but there are also essential differences. For practical purposes most crop plants in such northern districts are annual in function, whereas the native flora is overwhelmingly perennial; so that the survival significance of a climatic value in force for a single year or even for a number of years, as worked out for crop plants, is difficult to determine for the native flora. Again, nearly all climatic data have been accumulated in a single class of habitats, namely, those which have been attractive for human settlement. In the present case all of the stations are in agricultural communities or on the immediate shores of rivers and lakes where only a part of the natural vegetation types are represented. Hence only the most general suggestions of climato-vegetational relationships are possible with existing records and with our very limited knowledge of the way in which the plant cover reacts to the complex of factors.

For present purposes a period from 1920 to 1929, inclusive, involving records of temperature and precipitation at Hudson Hope, Grande Prairie, Peace River Crossing, Grouard, McMurray, Vermilion, and Chipewyan, has been used. The data have been

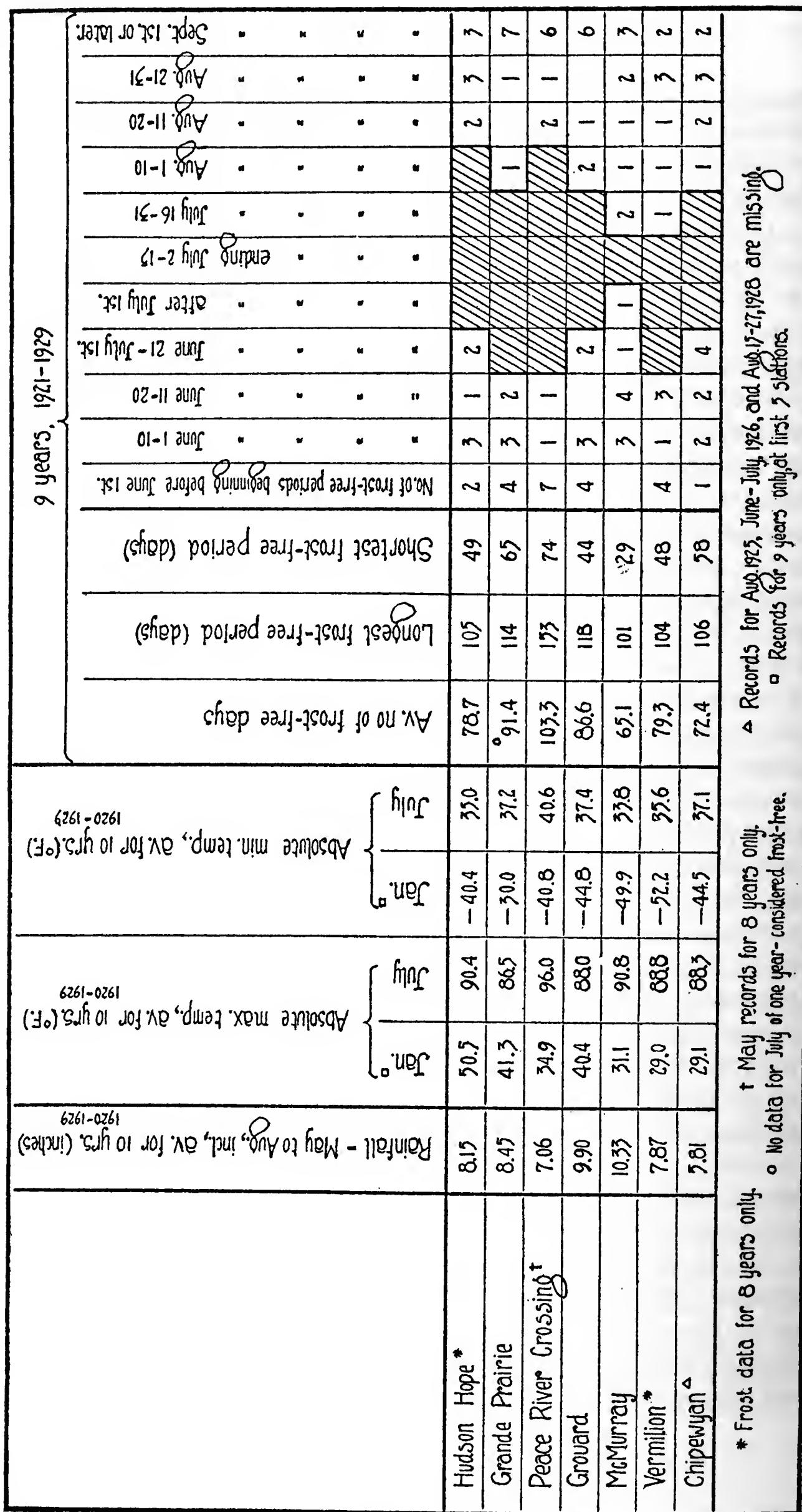
<sup>1</sup>Most of the data presented here were worked up at the libraries of the Astronomical Observatory and the Institute of Geographical Exploration of Harvard University. To the officials of these the writer is much indebted for assistance.

taken from the regular monthly publications of the Canadian Meteorological Service (70), and as the table (Fig. 1) shows, are incomplete in some respects. But the incompleteness has been tolerated in order to maintain simultaneous order. McMurray and Grouard, though not in the Peace River basin, are introduced for comparison. No extensive effort will be made to compare the climate of the Peace River region with that of other parts of the continent; consequently the data have been selected and organized mainly for comparisons within the basin itself.

The drainage basin of the Peace River east of the mountains experiences a climate which is relatively uniform over most of its area. As part of the great northern interior plain of the continent it has low rainfall and marked extremes in temperature. Although its summer climate resembles in many respects that of central Alberta, other seasons show steadily lower temperatures to the northward. Its high latitude produces long days in summer, with over 15 hours of sunlight possible daily from May to August, and between 17 and 18 hours in June. Most of the Alberta portion of the plateau has a mean annual precipitation of 10—15 inches, while the part lying in British Columbia according to Koeppe (48) averages 15—20 inches. As will be shown later, this difference is not so marked when only rainfall for the growing season is used for comparison.

Rainfall only has been considered in the total precipitation shown in the table. There are occasional snows in May and September, and rarely in June and August, but they are usually in small amount. The weather reports record this snow in terms of rainfall by dividing by ten, but as Koeppe has pointed out (48) this is unsatisfactory because the snow differs widely in specific gravity from place to place. What falls in May and June, or even in April, may be of significance to plant growth, but it is probably minimal in comparison with the rainfall.

In rainfall the stations fall into three groups: four averaging from about 7 to about 8.5 inches; two with more, 9.9 to 10.3 inches; and one, Chipewyan, with only 5.81. It should be noted that of the first four stations mentioned, those farthest to the northeast (Peace River Crossing and Vermilion) have less rain than the other two. In number of inches these variations are not great, but where the total effective precipitation is so low even small differences may loom large in importance. Hudson Hope,



\* Frost data for 8 years only.

- No data for July of one year - considered first half May records for 8 years only.

Records for Aug. 1925, June-July 1926, and Aug. 17-27, 1928 are missing.

- No data for July of one year - considered frost-free.
- May records for 8 years only.

FIGURE 1. CHART OF CLIMATIC DATA FOR THE PEACE RIVER REGION.

although it lies in a region of somewhat greater mean annual precipitation, is closely related to the other stations in summer rainfall. This may be attributed to the fact that its springs begin a little later, and consequently less spring rainfall is available to swell the total amount. It lies in a transition area between the plains where 50—60% of the annual precipitation comes from May to August, inclusive, and the Rockies where 40—50% comes in these months (48). The tendency to greater precipitation at Hudson Hope is therefore in part neutralized by the seasonal differences.

A longer series of observations seems to bear out the same relationships between the stations although the averages may vary. A 17-year period (1900—1917) at Athabaska Landing, similar in general conditions to McMurray, shows an average for June, July, and August<sup>1</sup> of 8.18 inches, as against 6.13 inches for Peace River Crossing (21 years, between 1890 and 1929), and 6.05 inches for Vermilion (22 years), thus showing the greater rainfall in the Athabaska valley. Chipewyan, on the other hand, over a period of 43 years shows an average which is considerably higher than for a 10-year interval, though with 5.3 inches it is still less than the stations up the Peace. There is an apparent discrepancy with the records at Beaver Lodge, in the Grande Prairie district. Seventeen years of data show less rainfall in the three summer months than does the 43-year average at Chipewyan, but it is thought that a greater number of records would probably raise the average of the former. Furthermore the positions are reversed when we take into account the longer growing season at Grande Prairie and the greater amount of effective precipitation in the spring and late summer or fall. The low rainfall at Chipewyan is similar to that at other stations in the central part of the Mackenzie basin such as Fort Smith, Resolution, and Hay River.

The mean temperatures for January lie between 0° and —15°, with the lower values farthest north. July means are about 60° for the whole region with the exception of a certain amount of cooling as the mountains are approached in British Columbia. Absolute maximum temperatures for July show the same uniformity as the means. From the standpoint of the growth and maturing of plants, absolute maximum and minimum temperatures, particularly during the open season, are regarded as most

<sup>1</sup>Only the summer months are used in this comparison with other periods in order to eliminate the doubtful snowfall value.

significant. Those for January and July are averaged over a period of 9 or 10 years and used for comparing the stations. Of all temperature data probably the most important is that relating to frosts and the so-called frostless season. For most of the period studied the daily temperatures have been published, so that we have a record of all absolute minimum temperatures of freezing or lower, and these are taken arbitrarily to indicate "frost" although it will be readily understood that they cannot always be used to show actual killing conditions. Rather they mark periods when plants are reduced to a very slow rate of vegetative activity in which there is a threat, and probably the actual occurrence of complete stoppage. The longest period of the year when the temperature does not drop to 32° F. is considered the frostless season, and a value for each station has been reached by averaging the lengths of such periods, in days, over 8 or 9 years (1921—9). Important indices to the significance of the frostless season, particularly where it is very short, are its dates of beginning and ending; so the seasons have been further classified on this basis, using as values the number of times during the period they have begun or ended within certain calendar limits.

January absolute minimum temperatures are of small importance in the comparison of the stations since at such consistently low temperatures plants will have long ceased to react. January absolute maxima however show a significant gradient upward as one ascends the Peace, from about 29° at Chipewyan and Vermilion, to about 35° at Peace River Crossing, 41° in the Grande Prairie district, and 50° at Hudson Hope. In the Athabaska basin the same thing is indicated by McMurray with 31° and Grouard with 40°. This may be attributed to the increasing effects, the farther upstream one goes, of the warm Chinook winds from the west and south west. Many travellers have described these winds which bring unusually high temperatures to the interior plateaus for short intervals in the winter. The weather records show that they occur with enough frequency to modify materially the average winter maxima. Their influence upon the plant growth of the region is probably indirect because they occur chiefly in the season of dormant vegetative activity. It is suggested that such of these winds as come in late winter or early spring may increase the availability of spring moisture by rendering the soil more receptive to melting snow water and rain at a time when these may be useful for the early stages of growth. This effect of the Chinook wind, if significant at all, would be felt

most in places where the frost-free season begins relatively early, as at Grande Prairie, Peace River Crossing, Grouard, and Vermilion; and least at Hudson Hope. It would tend also to increase the effectiveness of the already greater early rainfall of the upper and central Peace region as compared to Chipewyan. It has also been suggested that the Chinooks cause winter killing of plants east of the mountains (31).

Absolute maxima for July averaged over the period show a remarkable uniformity ( $86^{\circ}$ — $90^{\circ}$ ), with the only pronounced variation at Peace River Crossing. Here the average is  $96^{\circ}$ , with the thermometer going to  $100^{\circ}$  or over 4 times in the 10 years, once to  $102^{\circ}$ . The location in the valley, involving a long summer exposure to warm southern or western sun and limited air circulation, may account for the high temperatures at this place. The average absolute minima for July all range between  $35^{\circ}$  and  $40^{\circ}$  except for McMurray where the average is  $33^{\circ}$ , further indicating the great similarity of mid-summer climates throughout the whole area.

The absolute minima for the summer months are most significant when considered as frost data. As such they are second if not equivalent in importance to rainfall. McMurray appears to have the shortest average frostless season, of about 65 days. The longest and shortest seasons are also lower than the others: 101 and 29, respectively. Peace River Crossing, consistent with its high summer maxima, shows much the longest average frostless season, of about 103 days. Chipewyan has a shorter season than the Peace River stations, but not so short as McMurray, probably due to the ameliorating influence of Lake Athabaska. With regard to the time of beginning, the season at Peace River Crossing is again unique in starting before June 1st in 7 of the 9 years studied. The stations in the central part of the basin are rather uniform with about 4 seasons of the 9 having this early beginning, while Hudson Hope and Chipewyan are later with 2 and 1, respectively. McMurray seems to begin its season latest with none of the seasons before June 1st, and only 3 of them between the 1st and 10th of June. August frosts in these years came earliest at McMurray and Vermilion, and latest at Hudson Hope and Peace River Crossing. July is the only month which is relatively frost-free.

To summarize, the chief variations, in the Peace River basin east of the mountains, from a fairly uniform rainfall of 7 to 8.5

inches for the growing season are at the upper and lower ends. In the mountains, according to Koeppe (48), the May to August percentage of the yearly precipitation falls to 40 as against the 60 of the plains. However, as the table indicates, Hudson Hope, just east of the mountains, has a summer rainfall similar to that at points farther east. Chipewyan is near the northern limit of the 10-inch mean, a condition which is reflected in the relatively low rainfall during the growing season. Thus the widespread uniformity probably extends from the mountains northeastward to the vicinity of Vermilion, but below that point falls off to 5.5 or 6 inches at Chipewyan.

The most notable deviations from average frostless seasons of about 80—90 days, nearly half of which begin before June 1st, are at Hudson Hope where the seasons are usually a week or two later in beginning, and at Chipewyan where they are somewhat shorter, and where over half of them do not begin until after the 10th of June.

Chinook winds are common features of the winter climate, their influence being felt most in the upper part of the basin. Their effect upon plant life is possibly indirect by making more moisture available to plants for early spring growth, or direct by winter killing.

The lower Athabaska basin, as represented by Grouard, Athabaska Landing, and McMurray, is notable for a somewhat larger summer rainfall than the Peace, and for relatively short frost-free periods which begin late.

## GEOGRAPHIC STUDIES OF THE VEGETATION IN THE PEACE RIVER BASIN

### INTRODUCTION

Even a cursory examination of the vegetation in the Peace River drainage basin produces some general impressions which give character to the whole. Beginning at the highest elevations in the mountains, striking features are first, an alpine flora which is to a greater degree arctic than that of more southern latitudes; second, a rather abrupt timber line marking the upper limit of a coniferous forest which, though it has many representatives of the richer Cordilleran timber, is more closely related to the wide-spread "Canadian Forest" of the northern interior plains. Most of the Cordilleran elements seem to disappear suddenly east of

the mountains. The most notable variations from the timber of the interior plains are the parklands, or semi-open prairies which, though "patchy", are widely distributed throughout, reaching far to the north and northeast through the central part of the Mackenzie basin. The flora of the prairies and forests is in general remarkably uniform over this whole region, but examination shows that a certain number of species of the high plains just east of the mountains disappear on the lower Peace. Marshlands and sloughs are common everywhere, but they have their greatest development on the broad alluvial plains of the Peace-Athabaska delta, making one of the outstanding vegetational features in that part of the basin.

#### ARCTIC-ALPINE VEGETATION

The flora of the west side of Mt. Selwyn is divided into three major types, the upper and lower of which are most important. The arctic-alpine is separated from the forests of the lower slopes by a scrub transition which is not always well-defined. It is shown roughly on the diagram (Fig. 2) as occurring between

## LIST OF THE ARCTIC-ALPINE FLORA

1. Wide-ranging species of north temperate or arctic regions.
2. Species which occur also on the arctic coast or islands.
3. Species occurring also on the western arctic coast.
4. Cordilleran species.

	1	2	3	4		1	2	3	4
<i>Cystopteris fragilis</i>	X	X			<i>Tofieldia palustris</i>	X	X		
<i>Equisetum variegatum</i>		X	X		<i>Zygadenus elegans</i>	X			
<i>Lycopodium Selago</i>	X	X			<i>Veratrum Eschscholtzianum</i>				X
<i>Lycopodium alpinum</i>	X	X			<i>Salix reticulata</i>	X	X		
<i>Selaginella Standleyi</i>				X	<i>Salix polaris</i>				X
<i>Abies lasiocarpa</i>				X	var. <i>selwynensis</i>				
<i>Pinus contorta</i>				X	<i>Salix arctica</i>	X	X		
var. <i>latifolia</i>					<i>Salix brachycarpa</i>				
<i>Festuca brachyphylla</i>	X	X			var. <i>antimima</i>	X			
<i>Festuca vivipara</i>	X	X			<i>Salix glauca</i>	X	X		
<i>Festuca altaica</i>			X		<i>Salix Barclayi</i>				X
<i>Poa alpina</i>	X	X			<i>Salix Barrattiana</i>				X
<i>Poa laxa</i>	X	X			<i>Salix alaxensis</i>	X	X		
<i>Poa glacialis</i>			X		<i>Betula glandulosa</i>	X	X		
<i>Poa glauca</i>	X	X			<i>Alnus crispa</i>	X			
<i>Trisetum spicatum</i>	X	X			<i>Rumex Acetosa</i>				X
<i>Trisetum spicatum</i>				X	<i>Oxyria digyna</i>	X	X		
var. <i>molle</i>	X				<i>Polygonum viviparum</i>		X		
<i>Deschampsia cespitosa</i> var. <i>glauca</i>	X	X			<i>Claytonia lanceolata</i>	X			
<i>Calamagrostis purpurascens</i>	X	X			<i>Cerastium Beeringianum</i>		X		X
<i>Phleum alpinum</i>	X	X			<i>Arenaria verna</i>		X		
<i>Carex nardina</i>	X	X			var. <i>pubescens</i>	X			
<i>Carex phaeocephala</i>			X		<i>Arenaria Rossii</i>		X	X	
<i>Carex bipartita</i>	X	X			<i>Arenaria Rossii</i>				X
<i>Carex scirpoidea</i>	X	X			var. <i>columbiana</i>				X
<i>Carex capillaris</i>	X	X			<i>Arenaria obtusiloba</i>				X
<i>Carex albo-nigra</i>			X		<i>Silene acaulis</i>				
<i>Carex atrosquama</i>			X		var. <i>exscapa</i>	X	X		
<i>Carex ambusta</i>			X		<i>Silene acaulis</i>				
<i>Juncus Drummondii</i>				X	var. <i>subacaulescens</i>				X
<i>Luzula parviflora</i>	X	X			<i>Lychnis furcata</i>	X	X		
<i>Luzula spicata</i>	X	X			<i>Lychnis attenuata</i>				X

## LIST OF THE ARCTIC-ALPINE FLORA (continued)

	1	2	3	4		1	2	3	4
<i>Delphinium scopulorum</i> var. <i>glaucum</i>		X	X		<i>Saxifraga Lyallii</i>				X
<i>Aconitum delphinifolium</i>	X	X			<i>Saxifraga Nelsoniana</i>	X	X		
<i>Anemone parviflora</i>	X	X			<i>Saxifraga aizoides</i>	X	X		
<i>Anemone multifida</i> var. <i>hudsoniana</i>	X				<i>Saxifraga tricuspidata</i>	X	X		
<i>Anemone Richardsonii</i>	X	X			<i>Saxifraga flagellaris</i>	X	X		
<i>Anemone narcissiflora</i>			X		<i>Saxifraga oppositifolia</i>	X	X		
<i>Ranunculus pygmaeus</i>	X	X			<i>Mitella pentandra</i>				X
<i>Ranunculus Eschscholtzii</i>			X		<i>Parnassia fimbriata</i>				X
<i>Thalictrum alpinum</i>	X				<i>Parnassia Kotzebuei</i>	X	X		
<i>Thalictrum occidentale</i>				X	<i>Sorbus sitchensis</i>				X
<i>Caltha leptosepala</i>				X	<i>Fragaria glauca</i>	X			
<i>Papaver radicatum</i>	X	X			<i>Potentilla dissecta</i>				X
<i>Draba alpina</i>	X	X			<i>Potentilla nivea</i>	X	X		
<i>Draba incerta</i>			X		<i>Potentilla uniflora</i>				X
<i>Draba lonchocarpa</i>				X	<i>Potentilla fruticosa</i>	X	X		
<i>Draba fladnizensis</i>	X	X			<i>Sibbaldia procumbens</i>	X			
<i>Draba borealis</i>			X		<i>Dryas integrifolia</i>	X	X		
<i>Draba longipes</i>			X		<i>Astragalus adsurgens</i>	X			
<i>Draba cinerea</i>	X	X			<i>Astragalus alpinus</i>	X	X		
<i>Braya Henryae</i>				X	<i>Astragalus aborigennum</i>				
<i>Braya americana</i>	X				<i>Oxytropis foliolosa</i>	X	X		
<i>Cardamine umbellata</i>				X	<i>Oxytropis Maydelliana</i>				
<i>Arabis lyrata</i> var. <i>occidentalis</i>	X				<i>Oxytropis arctobia</i>	X	X		
<i>Arabis Drummondii</i>	X				<i>Oxytropis spicata</i>				X
<i>Arabis retrofracta</i>	X				<i>Oxytropis saximontana</i>				X
<i>Sedum stenopetalum</i>				X	<i>Oxytropis viscidula</i>				X
<i>Saxifraga cernua</i>	X	X			<i>Hedysarum alpinum</i>	X	X		
<i>Saxifraga adscendens</i>				X	<i>Hedysarum MacKenziei</i>	X	X		
<i>Saxifraga caespitosa</i>	X	X			<i>Lupinus arcticus</i>		X		X
<i>Saxifraga nivalis</i>	X	X			<i>Viola rugulosa</i>	X			
<i>Saxifraga Marshallii</i>				X	<i>Epilobium latifolium</i>	X	X		
					<i>Epilobium alpinum</i>	X	X		
					<i>Epilobium Hornemannii</i>		X		
					<i>Pyrola grandiflora</i>	X	X		
					<i>Rhododendron lapponicum</i>		X	X	

## LIST OF THE ARCTIC-ALPINE FLORA (continued)

	1	2	3	4		1	2	3	4
Rhododendron albiflorum				X	Erigeron aureus var. acutifolius				X
Loiseleuria procumbens	X	X			Erigeron compositus var. trifidus				X
Phyllodoce empetrifolia			X		Erigeron salsuginosus				X
Phyllodoce glanduliflora			X		Antennaria moncephala		X		
Cassiope tetragona	X	X			Antennaria atriceps				X
Cassiope Mertensiana				X	Antennaria megacephala				X
Arctostaphylos rubra	X	X			Antennaria isolepsis	X	X		
Primula egaliksensis	X	X			Antennaria cana	X			
Dodecatheon frigidum		X	X		Antennaria pulvinata				X
Gentiana propinqua	X	X			Antennaria umbellinella				X
Gentiana prostrata			X		Chrysanthemum integrifolium	X	X		
Gentiana glauca			X		Artemisia borealis var. Purshii	X	X		
Polemonium lanatum		X	X		Artemisia norvegica			X	
Myosotis alpestris		X	X		Artemisia discolor				X
Mertensia paniculata	X				Petasites nivalis				X
Castilleja miniata			X		Arnica cordifolia				X
Castilleja sp.			X		Arnica chionopappa	X			
Castilleja sp.	X				Arnica Parryi				X
Castilleja sp.			X		Arnica alpina	X	X		
Pedicularis labradorica	X				Arnica tomentosa	X			
Pedicularis sudetica	X	X			Arnica obtusifolia var. acuta				X
Pedicularis Oederi			X		Senecio lugens		X	X	
Pedicularis lanata	X	X			Senecio cymbalariae				
Pedicularis capitata	X	X			oides var. borealis	X			
Campanula uniflora	X	X			Cirsium Drummondii				X
Campanula lasiocarpa			X		Crepis nana	X	X		
Campanula rotundifolia var. alaskana	X				Hieracium albiflorum				X
Solidago multiradiata	X				Taraxacum lacerum	X			
Aster Richardsonii		X	X		Taraxacum lyratum		X	X	
Erigeron unalascensis	X	X			Taraxacum lapponicum				
					Total	99	85	29	54

The preceding list of alpine plants is compiled from the 1932 collections on Mt. Selwyn, and from the specimens secured in 1931—32 by Mrs. Henry in the mountains north of Hudson Hope. It is probably far from complete but should give some idea of the relationships of the flora. The indefiniteness of the timber line makes it difficult to separate the alpine and upper forest species, but the former are here made to include such species of the latter, exclusive of those in damp gully thickets, as are found extending above the areas of continuous timber, and the isolated dwarfed trees such as pine and fir are thus included. In part at least this follows the plan of Rydberg (88) who made both his alpine and montane forest lists to include the subalpine scrub.

Nearly half of the total 182 species (46.6%) in this list are to be found either on the arctic rim of the continent or also on the arctic archipelago. Most of these (70 spp.) belong to the latter group, but some reach the arctic coast only in the west and are consequently grouped with the western arctic species in the list. A few such as *Arenaria Rossii*, *Salix alaxensis*, and *Lupinus arcticus* extend eastward to the western or southwestern part of the archipelago. About 38% of the known alpine flora therefore may be regarded as of wide range in the American arctic, much of it common to Eurasian polar regions as well.

Another group of species with extended ranges, but not found on the arctic coast or islands, is as follows:

<i>Trisetum spicatum</i> var. <i>molle</i>	<i>Sibbaldia procumbens</i>
<i>Zygadenus elegans</i>	<i>Astragalus adsurgens</i>
<i>Salix brachycarpa</i>	<i>Viola rugulosa</i>
var. <i>antimima</i>	<i>Epilobium Hornemannii</i>
<i>Alnus crispa</i>	<i>Mertensia paniculata</i>
<i>Claytonia lanceolata</i>	<i>Castilleja</i> sp.
<i>Cerastium Beeringianum</i>	<i>Pedicularis labradorica</i>
<i>Arenaria verna</i> var. <i>pubescens</i>	<i>Campanula rotundifolia</i>
<i>Anemone multifida</i>	var. <i>alaskana</i>
var. <i>hudsoniana</i>	<i>Solidago multiradiata</i>
<i>Thalictrum alpinum</i>	<i>Antennaria cana</i>
<i>Braya americana</i>	<i>Arnica chionopappa</i>
<i>Arabis Drummondii</i>	<i>Arnica tomentosa</i>
<i>Arabis lyrata</i> var. <i>occidentalis</i>	<i>Senecio cymbalariaeoides</i>
<i>Arabis retrofracta</i>	var. <i>borealis</i>
<i>Fragaria glauca</i> (and <i>F. virginiana</i> )	<i>Taraxacum lacerum</i>
	<i>Taraxacum lapponicum</i>

These are mainly plants of more exposed situations in the northern forests. Some are limited to the western interior of the continent, but most of them extend eastward to the St. Lawrence basin. A few such as *Claytonia lanceolata*, *Braya americana*, *Campanula rotundifolia* var. *alaskana*, *Solidago multiradiata*, *Antennaria cana*, *Arnica tomentosa*, and *Taraxacum lacerum* have much broken ranges, not yet having been found between the region about the Gulf of St. Lawrence and the Rocky Mountains.

Of the total alpine flora, therefore, 99 species, or about 54%, have extended ranges outside the mountains, chiefly in the arctic regions. The remaining 83 distinctly cordilleran species are, as would be expected, largely northern in their affinities. Some are far-northwestern species of Asiatic relationships which find in the Canadian mountains their southern and eastern limits in America so far as is known. To this class belong *Festuca altaica*, *Draba borealis*, *Gentiana prostrata*, and *Campanula lasiocarpa*. Three of the novelties described in the present paper are related to this group since their affinities are clearly western arctic or northwestern cordilleran: *Salix polaris* var. *selwynensis*, *Draba longipes*, and *Arnica obtusifolia* var. *acuta*. More southern cordilleran species, which find their northern limits in the mountains of northern British Columbia, but which have not been found in Yukon or Alaska, are as follows:

<i>Selaginella Standleyi</i>	<i>Saxifraga adscendens</i>
<i>Carex phaeocephala</i>	<i>Potentilla dissecta</i>
<i>Carex albo-nigra</i>	<i>Oxytropis spicata</i>
<i>Carex atrosquama</i>	<i>Rhododendron albiflorum</i>
<i>Arenaria obtusiloba</i>	<i>Castilleja miniata</i>
<i>Silene acaulis</i>	<i>Antennaria pulvinata</i>
var. <i>subacaulescens</i>	<i>Antennaria umbrinella</i>
<i>Thalictrum occidentale</i>	<i>Artemisia discolor</i>
<i>Caltha leptosepala</i>	<i>Arnica Parryi</i>
<i>Draba lonchocarpa</i>	<i>Cirsium Drummondii</i> <sup>1</sup>
<i>Draba incerta</i>	

Species apparently localized in the mountains of Alberta and British Columbia, including the novelties described in this paper, are:

<sup>1</sup>Extends to the central part of the Mackenzie basin.

<i>Salix polaris</i> var. <i>selwynensis</i>	<i>Castilleja</i> sp.
<i>Salix Barrattiana</i>	<i>Castilleja</i> sp.
<i>Lychnis attenuata</i>	<i>Erigeron aureus</i>
<i>Arenaria Rossii</i>	var. <i>acutifolius</i>
var. <i>columbiana</i>	<i>Antennaria atriceps</i>
<i>Draba longipes</i>	<i>Antennaria megacephala</i>
<i>Braya Henryae</i>	<i>Arnica obtusifolia</i> var. <i>acuta</i>

There are 31 species of more extended range in the cordillera, reaching from Alaska or Yukon south of the 49th parallel. Some of them are found in Arizona, New Mexico, or California. Most are confined to the cordilleran region but a few, marked \* in the following list, range eastward into the central part of the MacKenzie basin.

<i>Abies lasiocarpa</i>	<i>Potentilla uniflora</i>
* <i>Pinus contorta</i> var. <i>latifolia</i>	* <i>Oxytropis viscidula</i>
<i>Juncus Drummondii</i>	<i>Oxytropis saximontana</i>
<i>Veratrum Eschscholtzianum</i>	<i>Phyllodoce empetriflora</i>
<i>Salix Barclayi</i>	<i>Phyllodoce glanduliflora</i>
<i>Rumex Acetosa</i>	<i>Cassiope Mertensiana</i>
<i>Arenaria verna</i>	<i>Gentiana glauca</i>
<i>Anemone narcissiflora</i>	<i>Pedicularis Oederi</i>
<i>Ranunculus Eschscholtzii</i>	* <i>Aster Richardsonii</i>
<i>Cardamine umbellata</i>	* <i>Erigeron compositus</i>
<i>Sedum stenopetalum</i>	var. <i>trifidus</i>
<i>Saxifraga Marshallii</i>	<i>Erigeron salsuginosus</i>
<i>Saxifraga Lyallii</i>	<i>Artemisia norvegica</i>
<i>Mitella pentandra</i>	<i>Petasites nivalis</i>
<i>Parnassia fimbriata</i>	<i>Arnica cordifolia</i>
* <i>Sorbus sitchensis</i>	<i>Hieracium albiflorum</i>

To these should be added a group which also reach the arctic coast. Whether they should be considered as cordilleran or arctic species is uncertain:

<i>Arenaria Rossii</i>	<i>Dodecatheon frigidum</i>
<i>Delphinium scopulorum</i>	<i>Myosotis alpestris</i>
var. <i>glaucum</i>	<i>Senecio lugens</i>
<i>Astragalus aboriginum</i>	<i>Taraxacum lyratum</i>

A comparison of this alpine flora with that of the more southern Canadian Rockies is rendered difficult by the fact that the latter

has never been listed in detail. The most extensive treatment available is that of Miss Edith M. Farr covering the area along the Canadian Pacific Railway (27), but the species are not noted in their relation to the timber line so that it is impossible to draw up a list for comparison. The same is true for Brown and Schäffer's *Alpine Flora of the Canadian Rocky Mountains* (4), and Henry's *Flora of Southern British Columbia* (33). However, the species in the two floras which range north and northeast to the arctic coast or islands may be compared, and we find in the northern group 20 species which appear to find their southern limit there, thus constituting a set of indicators for the more arctic nature of the flora. These are:

Festuca vivipara	Oxytropis arctobia
Poa laxa	Hedysarum alpinum
Salix reticulata	Pyrola grandiflora
Salix arctica	Rhododendron lapponicum
Salix alaxensis	Loiseleuria procumbens
Draba cinerea	Polemonium lanatum
Saxifraga nivalis	Pedicularis sudetica
Saxifraga aizoides	Pedicularis capitata
Lupinus arcticus	Antennaria isolepis
Oxytropis Maydelliana	Chrysanthemum integrifolium

On the other hand, of about a dozen arctic species noted by Miss Farr but not yet found farther north in the mountains, nearly all are of comparatively wide range in the cordilleran region and will undoubtedly be found eventually in the Peace and Liard regions.

To summarize, the alpine flora of the upper Peace and Liard River basins may be divided into three elements: arctic, wide-ranging north temperate or subarctic, and cordilleran. The first and third tend to overlap when the western arctic species are considered. About 47% of the total 182 species are common to the arctic coast of the continent or the arctic archipelago, and 70 of these, or about 38% of the total, range widely through the arctic part of the continent, while the remaining 15 species are western arctic and more closely related to the cordilleran element. The second and smallest element is composed of 29 species, or about 16%, which have extended ranges eastward in the north temperate coniferous forest or subarctic regions. Most of these occur in the district about the Gulf of St. Lawrence, and some are notable

for apparently disrupted ranges. The third element is characteristic of the mountainous country, particularly the northern part. Eighty-three species belong in this group, or about 46% of the whole (including the western arctic plants, or about 8% of the whole). Of this number, 38 (about 21%) have wide ranges in the northern cordillera, 20 (about 11%) reach their northern limits in the region under discussion, 13 (about 7%) reach their southern limits in Alberta and British Columbia, and 12 (about 5%) are endemic in the northern Rockies. Of the arctic element about 20 species reach their known southern limits in the Peace River region.

An analysis of the alpine flora of Mt. Selwyn in the light of the above classification leads to some interesting results. Of the 8 species of vascular plants collected on the summit, *Salix polaris* var. *selwynensis* is apparently endemic in the northern cordillera but with northwestern arctic affinities, *Selaginella Standleyi* is endemic in the central and northern Rockies, while the remainder are widely distributed arctic species. Between 5000 and 6000 feet there were collected 82 species of which 18 are of non-arctic cordilleran affinity, and 7 are wide-ranging Canadian, leaving 57 arctic species. Ninety-seven species collected between timber line and 5000 feet include 53 arctic, 27 non-arctic cordilleran, and 17 wide-ranging non-arctic forms. The resulting proportions are as follows:

	Arctic	Cordilleran	Wide-spread non-arctic
Summit	6 (75%)	2 (25%)	0
5—6000 ft.	57 (70%)	18 (22%)	7 (8%)
Timber line — 5000 ft.	53 (55%)	27 (28%)	17 (17%)

The preponderance of arctic species seems to be maintained at elevations of 5000 feet or more, but with diminishing influence; while there is an increase of cordilleran and wide-spread non-arctic species from higher to lower levels. Wide-ranging non-arctic species are entirely unrepresented at the summit.

The alpine vegetation on the western slopes of Mt. Selwyn may be divided roughly into two types. The lower extends from timber line to 5000 or 6000 feet depending upon slope and exposure, and is characterized by shrubby thickets which dwindle to woody mats at higher levels and are interspersed with grassy meadows.

Most of the slope is steep and stony with the soils fairly well watered at least at the surface. In the lower part of the area the predominant shrubs are *Rhododendron albiflorum*, *Betula glandulosa*, and *Salix* spp. (*S. Barclayi*, *S. Barrattiana*, *S. glauca*). Secondary species include dwarfed trees from the forest of the lower slopes and several species from the scrub thickets (see page 67). Judging from available descriptions this bush in which *Rhododendron* plays so important a part is not found in the mountains farther south where *R. albiflorum* is largely confined to open timbered hillsides (4, 88).

Over large areas in the lower part of the alpine zone there is a turf in which the northwestern grass, *Festuca altaica*, is prominent. On other fairly stable soils there are thick mats formed of *Dryas integrifolia*, *Salix reticulata*, *S. polaris* var. *selwynensis*, and much-dwarfed *Betula glandulosa*. Exposed rock crevices and ledges have a rather distinctive flora which ranges widely in altitude. Characteristic members of it are as follows: *Salix brachycarpa* var. *antimima*, *Cerastium Beeringianum*, *Silene acaulis* var. *exscapa*, *Draba* spp., *Saxifraga tricuspidata*, *S. caespitosa*, *Potentilla fruticosa*, *P. uniflora*, *Oxytropis arctobia*, *O. saximontana*, *Erigeron unalaschkensis*, *E. compositus* var. *trifidus*, *Antennaria moncephala*, *A. atriceps*, *Taraxacum lacerum*.

*Saxifraga tricuspidata* is probably the commonest of these, forming a thick covering on dry ledges. Damp springy rock ledges usually have a mossy cover and a varied flora in which the following species are abundant: *Lycopodium Selago*, *Carex ambusta*, *Luzula parviflora*, *Empetrum nigrum*, *Phyllodoce empetrifolia*, *P. glanduliflora*. Springy slopes of looser soil are characterized by *Ranunculus Eschscholtzii*, *Saxifraga Marshallii*, *S. aizoides*, *Anemone parviflora*, and many others.

The upper part of the alpine region has comparatively open associations in which the commonest species are lichens (*Cetraria* sp. and others), *Selaginella Standleyi*, and *Salix polaris* var. *selwynensis*. The ground is stony and for much of the year is snow-covered, many of the larger snow banks being perennial. Most of the dwarf mat-forming shrubs disappear completely at the higher levels.

From these scanty notes it may be seen that the group of species which make up most of the plant cover above timber line are of arctic affinity or have their greatest development in the

northern cordillera: *Betula glandulosa*, *Salix Barclayi*, *S. Barattiana*, *S. glauca*, *S. reticulata*, *S. polaris* var. *selwynensis*, *Festuca altaica*, *Saxifraga tricuspidata*, *Dryas integrifolia*. Exceptions are *Rhododendron albiflorum* and *Selaginella Standleyi*, neither of which ranges far into the southern Rockies. Time in the field did not permit of more detailed descriptions of the types of alpine habitat, although such would be most desirable.

No accurate data on climatic conditions in the Mt. Selwyn district are available. The upper slopes are completely exposed to westerly winds blowing across the broad valley of the "Rocky Mountain Trench", and undoubtedly derive from them a goodly supply of moisture. Judging by experience in the summer of 1932 the precipitation is frequent, and mainly in the form of mists and light rains which keep the soil surfaces moist but do not penetrate to any great depth.

#### OCCURRENCE OF ALPINE PLANTS AT RIVER LEVEL

Before leaving the vegetation of the alpine region it is necessary to discuss the occurrence of various members of the alpine flora on the banks of the larger streams at elevations of about 2000 feet. About 40 species, listed below, found above timber line have also been noted on the stream banks or on rock slides very near them. Most of these inhabit damp sandy or muddy banks very close to the water's edge where they are inundated in flood times; making their habitat exceedingly unstable, and the existence of any plants at all quite hazardous.

<i>Cystopteris fragilis</i>	<i>Salix alaxensis</i>
<i>Equisetum variegatum</i>	(var. <i>longistylis</i> )
<i>Poa alpina</i>	<i>Salix Barclayi</i>
<i>Poa glauca</i>	<i>Polygonum viviparum</i>
<i>Deschampsia cespitosa</i> var. <i>glauca</i>	<i>Arenaria verna</i> var. <i>pubescens</i>
<i>Trisetum spicatum</i> var. <i>molle</i>	<i>Anemone parviflora</i>
<i>Calamagrostis purpurascens</i>	<i>Anemone multifida</i> var. <i>hudsoniana</i>
<i>Carex scirpoidea</i>	<i>Thalictrum occidentale</i>
<i>Carex capillaris</i>	<i>Arabis lyrata</i> var. <i>occidentalis</i>
<i>Zygadenus elegans</i>	<i>Draba borealis</i>
<i>Tofieldia palustris</i>	<i>Draba cinerea</i>

Saxifraga Marshallii	Epilobium latifolium
Saxifraga aizoides	Gentiana propinqua
Saxifraga tricuspidata	Aster Richardsonii
Parnassia Kotzebuei	Erigeron unalaschkensis
Parnassia fimbriata	Solidago multiradiata
Potentilla fruticosa	Antennaria umbrinella
Fragaria glauca	Artemisia discolor
Oxytropis saximontana	Arnica chionopappa
Hedysarum Mackenzii	Taraxacum lacerum
Viola rugulosa	

The striking feature of this list is the preponderance of species with widely extended ranges in arctic or north temperate regions. Only 6 species (*Thalictrum occidentale*, *Saxifraga Marshallii*, *Parnassia fimbriata*, *Oxytropis saximontana*, *Antennaria umbrinella*, and *Artemisia discolor*) are distinctly cordilleran, and they are all derived from the lower part of the alpine zone on Mt. Selwyn. On the other hand one of the 8 species from the summit, and 19 of those from the 5—6000 foot zone are present. If the forest habitats at lower levels are taken into account the contrast is still there, but less marked because of the closer relationship between the lower part of the alpine zone and the montane forests. An analysis of the more widely extended species shows 9 which are non-arctic and 25 which are to be found either on the arctic coast or islands, or both.

These facts suggest some geographic hypotheses which are set forth here with some hesitation because of the meagerness of the data at hand. It appears that by far the greater part of the alpine cordilleran species (and nearly all of the high alpine ones) remain strictly alpine in this latitude whereas species of wider range in arctic and subarctic regions are less selective, and are to be found at the highest and lowest elevations within the mountains. It follows that the complex of environmental factors, of which climate is probably the most important, and which permits the growth of the arctic flora, exists at both high and low elevations, and that the high alpine cordilleran species have for some reason been unable to occupy the river bank habitats although they grow almost directly above them. These habitats represent the nearest approach, at low levels, to the soil conditions of the alpine areas with their physically unstable soils and good drainage.

Two possible explanations are suggested. It may be considered that by ordinary means of dispersal all available habitats in this region of subarctic conditions which are suitable for the alpine species would be occupied by them; and the river banks and low rock slides are the only places at or near river level which are available. If this is the case then we must suppose that the cordilleran alpine species are nearly all so different in structure and function from the arctic ones that they are unable to effect this short expansion of range, although the two elements exist side by side at higher elevations. It is a matter of common observation that species at the margins of their ranges tend to be more selective of habitats; and that consequently the cordilleran species, many of which here reach their northern limits, are thus restricted in distribution. But the same may be said of many of the arctic species which seem to reach their southern limit here.

Again, we may look upon the northern cordilleran region as a vast area of environmental overlap in arctic and northern-forest conditions. As indicated above, whatever the general conditions may be they obviously tolerate both vegetations. To be consistent with what we know about the post-Glacial history of these northwestern floras we must consider the forests as having invaded a vegetation resembling the modern arctic tundra. The mountain sides were covered to such elevations as the local montane climates would permit, the tundra persisting only at the higher elevations. The existence of arctic-alpine plants at river levels in the Peace River region, however, suggests that some elements of the tundra have persisted in such lowland habitats as are available. The forest is unable to invade them on account of flooding and general instability of the soil. We might then consider that the tundra has been invaded from below by the coniferous forest, and is accompanied in the alpine areas by the cordilleran plants of high elevations.

#### THE CORDILLERAN FOREST

Most of the mountain slopes below altitudes of 3500—4500 feet in the Mt. Selwyn district are covered with a thick coniferous forest which, although containing many cordilleran elements, is closely related to the wide-spread timber of the northern interior plains. This relationship was pointed out many years ago by

G. M. Dawson (20) who wrote, "In the northern part of the interior of the province [B. C.], just such an assemblage of plants is found as may be seen in many parts of eastern Canada, though mingled with unfamiliar stragglers. This flora appears to run completely across the continent north of the great plains, and characterizes a region with moderately abundant rainfall, summers not excessively warm, and cold winters". Recent findings substantiate Dawson's conclusions for the most part. He gives as one of the characteristic trees of the whole upper Peace region, *Picea Engelmanni*, which appears to be rare or non-existent in the immediate valley of the river. However, in another place he says, "Varieties occur, which, according to Dr. Engelmann, who has examined my specimens, are almost indistinguishable from *Picea alba* [*P. glauca*], and to the north-eastward these varieties preponderate". Specimens collected by him south of the Peace near the Echafaud (Pouce Coupé) River "are still referable to *P. Engelmanni*, but trees on the Athabasca (lat.  $54^{\circ} 7' 34''$ , long.  $118^{\circ} 48'$ ) belong to *P. alba*. The northern and north-eastern range of Engelmann's spruce is therefore undeterminate". This confusion is shown further by specimens collected on Carbon River in 1932 (see list) which are very doubtfully referred to *P. Engelmanni*.

Lewis, Dowding, and Moss, in a map of the vegetation of Alberta (50), have a line dividing the northern coniferous and cordilleran forests which runs northwestward across the Peace, 40—50 miles below Peace River Crossing. This line appears to be based largely upon the ranges of *Pinus Banksiana* and *P. contorta* var. *latifolia*. Discussing the cordilleran forest the authors state, "This phytogeographical region is marked by the gradual disappearance of most of the trees of the Atlantic type and their replacement by trees belonging to the Pacific floral province. As might be expected, the change is gradual and there is much overlapping, but the boundary is rendered more obvious by the dominance of *Pinus Banksiana* in the northern coniferous forest and of *Pinus contorta* in the Cordilleran formation. The two species only overlap to the east of the Lesser Slave Lake and as far south as Athabasca". The chief trees in this region are given as *Pinus contorta*, *P. albicaulis* (at higher levels towards the mountains), *Picea albertiana*, *P. Engelmanni*, *Pseudotsuga Doug-*

*lasii*, *Abies lasiocarpa* (at higher levels towards the mountains). *Picea albertiana*, which they maintain as a distinct species, is of very doubtful value. The writer now has a large series of specimens from many parts of the upper and central Mackenzie basin, and has compared them with others from eastern Canada, all with the result that no separation of it from *P. glauca* seems advisable at present.

In the light of this and other knowledge accumulated in recent years it seems necessary, so far as the Peace River region is concerned, to return to Dawson's concept. Of the species mentioned by Lewis, Dowding, and Moss, the status of *P. Engelmanni* in this region has already been discussed. *Pseudotsuga Douglasii* is entirely unknown in the basin of the Peace except on its southern headwaters, as is also *Pinus albicaulis*. *Abies lasiocarpa* occurs in the Lesser Slave Lake district but we have no definite knowledge of it on the Peace outside the mountains. And if the white spruce is to be maintained as identical with *P. glauca*, as seems necessary at present, then the wide-ranging Canadian coniferous forest type must extend westward at least to the Peace River Pass. The balsam fir of the eastern forests must reach its western limit somewhere in the central Athabaska River country much as it does its northwestern one on the lower Athabaska (83). If *Pinus contorta* is still used as an indicator species then further difficulties arise since it has been found far to the northeastward, at the eastern edge of the Caribou Mountain plateau (85). It is not improbable that when more of the upland forests in the vast country bordering the Peace and Liard River drainage basins are better known, much overlapping of the so-called northern coniferous forest, characterized in the north chiefly by *Picea glauca*, by northeastern expansions of cordilleran influences will become evident. The latter are to be looked for on the heights of land, chiefly erosion plateaus of Cretaceous rock, while the former may be found distributed at lower levels and on younger land surfaces.

The following list will serve to describe the floristic content of the forests of the upper Peace. It does not include all of the plants of the subalpine scrub, nor of local modifications in the timber, for these will be considered separately. It includes nearly all of the species found in the rich woods on slopes and local flood plains.

<i>Cystopteris fragilis</i>	<i>Actaea rubra</i>
<i>Pteretis nodulosa</i>	<i>Aquilegia columbiana</i>
<i>Thelypteris Dryopteris</i>	<i>Aconitum delphinifolium</i>
<i>Thelypteris spinulosa</i>	<i>Clematis verticillaris</i>
var. <i>dilatata</i>	var. <i>columbiana</i>
<i>Athyrium Filix-femina</i>	<i>Thalictrum occidentale</i>
<i>Equisetum pratense</i>	<i>Saxifraga tricuspidata</i>
<i>Equisetum scirpoides</i>	<i>Tiarella unifoliata</i>
<i>Equisetum variegatum</i>	<i>Mitella nuda</i>
<i>Lycopodium annotinum</i>	<i>Ribes laxiflorum</i>
<i>Lycopodium obscurum</i>	<i>Ribes lacustre</i>
var. <i>dendroideum</i>	<i>Ribes triste</i>
<i>Lycopodium complanatum</i>	<i>Spiraea lucida</i>
<i>Picea glauca</i>	<i>Aruncus acuminatus</i>
<i>Picea Engelmanni</i>	<i>Amelanchier florida</i>
<i>Abies lasiocarpa</i>	<i>Rubus idaeus</i> var. <i>canadensis</i>
<i>Pinus contorta</i> var. <i>latifolia</i>	<i>Rubus parviflorus</i>
<i>Juniperus communis</i>	<i>Rubus pubescens</i>
var. <i>montana</i>	<i>Acer glabrum</i> var. <i>Douglasii</i>
<i>Cinna latifolia</i>	<i>Viola renifolia</i> var. <i>Brainerdii</i>
<i>Oryzopsis asperifolia</i>	<i>Shepherdia canadensis</i>
<i>Carex Deweyana</i>	<i>Circaeа alpina</i>
<i>Carex concinna</i>	<i>Oplopanax horridum</i>
<i>Clintonia uniflora</i>	<i>Aralia nudicaulis</i>
<i>Smilacina amplexicaulis</i>	<i>Osmorhiza obtusa</i>
<i>Maianthemum canadense</i>	<i>Cornus canadensis</i>
var. <i>interius</i>	<i>Chimaphila umbellata</i>
<i>Disporum trachycarpum</i>	<i>Moneses uniflora</i>
<i>Streptopus amplexifolius</i>	<i>Pyrola minor</i>
<i>Habenaria obtusata</i>	<i>Pyrola secunda</i>
<i>Habenaria orbiculata</i>	<i>Pyrola chlorantha</i>
<i>Epipactis repens</i>	<i>Pyrola asarifolia</i>
<i>Epipactis decipiens</i>	and var. <i>incarnata</i>
<i>Listera cordata</i>	<i>Arctostaphylos Uva-ursi</i>
<i>Calypso bulbosa</i>	var. <i>adenotricha</i>
<i>Corallorrhiza trifida</i>	<i>Vaccinium membranaceum</i>
<i>Corallorrhiza maculata</i>	<i>Mertensia paniculata</i>
<i>Populus tremuloides</i>	<i>Viburnum pauciflorum</i>
<i>Populus tacamahaca</i>	<i>Linnaea borealis</i>
<i>Betula papyrifera</i>	var. <i>americana</i>
var. <i>occidentalis</i>	<i>Lonicera involucrata</i>
<i>Alnus crispa</i>	<i>Aster conspicuus</i>
<i>Geocaulon lividum</i>	<i>Arnica cordifolia</i>

The primary species are of course *Picea glauca* and *Abies lasiocarpa*, with the first by far the most prominent. In the undergrowth *Alnus crispa* is the commonest shrub, though *Amelanchier*, *Viburnum*, and others are abundant in some places. On the ground the cover is a thick mat of woodland mosses except on the newer flood plains where they have not had as yet a chance to develop. Of the 78 species in the above list 25 are typically cordilleran, but none of them have much prominence in the forest facies except *Abies lasiocarpa*, which is sufficiently abundant to be reckoned as of primary importance, and possibly *Betula papyrifera* var. *occidentalis* which is common in places. Dawson's conception of the similarity of the forest, in general aspect, to that of the northern interior plains is thus further substantiated.

Small openings in the timber encourage the growth of the shrubs and herbs so that thickets of *Rubus*, *Viburnum*, *Rosa*, and *Shepherdia canadensis* occur. The main modifications in the mountain forests, however, are in the timber-line scrub, damp mountain-side gullies, rock slides, and on recently formed flood plain deposits of one sort or another. Secondary influences such as fire and clearing have not been studied in detail. The first has undoubtedly been of some importance throughout the vegetational history of the region, but its more recent effects upon the Mt. Selwyn district await further investigation. Most of the area studied has not been burned over for a very long time. The building of every cabin involves some clearing, so that we have some idea of local changes caused in this way.

The scrub timber in the upper part of the forest involves chiefly the thinning out and reduction in size of the primary timber trees. The prevalence of dry, semi-exposed rock ledges brings *Pinus contorta* var. *latifolia* into greater prominence than it enjoys in the rich woods. Intervening areas are taken over by shrubs derived from both alpine and forest zones: *Alnus crispa*, *Rhododendron albiflorum*, *Betula glandulosa*, *Salix glauca*, *Salix Barclayi*; or by small grassy meadows in which *Bromus Richardsonii* is a prominent species. Alpine plants which commonly come into the scrub are:

<i>Poa alpina</i>	<i>Epilobium Hornemannii</i>
<i>Luzula parviflora</i>	<i>Erigeron salsuginosus</i>
<i>Salix alaxensis</i>	<i>Antennaria monocephala</i>
<i>Draba borealis</i>	<i>Artemisia norvegica</i>
<i>Saxifraga cernua</i>	<i>Senecio lugens</i>

Though scattered, most of the flora of the rich woods is represented. Still another element is a group of species which on Mt. Selwyn are commonly found only in the scrub:

Woodsia scopulina	Pedicularis bracteosa
Thelypteris fragrans	Arnica latifolia
Polypodium virginianum	Hieracium albiflorum
Castilleja sp.	Hieracium gracile
Veronica Wormskjoldii	Agoseris gaspensis

Deep gullies are of common occurrence on the mountain-sides. Above timber-line their vegetation dwindles into an open association characteristic of wet springy slopes of unstable soils, while at lower levels the vegetation merges with that of drier openings in the forest. In the neighborhood of timber-line the rather distinctive flora of these steep channels is best developed, and consists of grassy thickets of *Sambucus pubens*, *Sorbus sitchensis*, *Alnus crispa*, *Salix Barclayi*, *Salix Barrattiana*, and *Betula glandulosa*. There is a thick herbaceous cover, often several feet high:

Veratrum Eschscholtzianum	Aconitum delphinifolium
Urtica (gracilis?)	Geranium Richardsonii
Aquilegia columbiana	Heracleum lanatum
Delphinium scopulorum	Valeriana sitchensis
var. glaucum	Senecio triangularis

All of these plants, although occurring elsewhere also, seem to attain their most rank growth in the gullies.

Rock slides are among the more xerophytic habitats in the forest, and draw from it only such plants as can stand these conditions. *Anemone multifida* var. *hudsoniana*, *Saxifraga tricuspidata*, and *Poa glauca* are characteristic among the sparse vascular flora.

Though the valley of the Peace is quite narrow, yet the river has done a certain amount of meandering in the process of cutting out its channel. This has given rise to local flood plain deposits which may be roughly classified into two groups involving fine materials such as clay or sand, and coarse gravel or boulders. The accompanying phenomena of abandoned channels and ponded water, often modified by beaver dams, are present though on a small scale.

Low gravel bars which are subject to inundation at any time during the summer are quite barren; but slightly higher ones which are commonly exposed, say, after late June, have a very open association of *Epilobium latifolium*, *Dryas Drummondii*, and *Deschampsia cespitosa* var. *glaucia*. These plants must be able to withstand tremendous hardships during times of high water when the gravel and boulders which constitute their anchorage are more or less in motion. *Deschampsia* has a large and deep mass of fibrous roots, while the others have rootstocks which form interlacing mats among the rocks. Higher and more stable bars develop a dense mat of *Dryas Drummondii*, a species which also colonizes steep cut banks of sliding sand and stones. With this greater stability come the first beginnings of the timber, *Salix Mackenziana*, *Salix subcoerulea*, *Salix alaxensis* var. *longistylis*, *Salix Barclayi*, *Populus tacamahaca*, *Picea glauca*, and *Elaeagnus argentea*. Additional herbaceous species also appear: *Oxytropis saximontana*, *Campanula rotundifolia*, *Hedysarum Mackenzii*, *Parnassia montanensis*, *Arabis lyrata* var. *occidentalis*, *Epilobium leptocarpum* var. *Macounii*, *Galium boreale*, *Solidago decumbens*, *Aster Richardsonii*, *Erigeron acris* var. *debilis* and var. *arcuans*, *Artemisia discolor*, *Senecio pauperculus*. The spruces and poplars finally dominate and produce a mesophytic forest with characteristic shrub and ground cover.

Sand and mud bars on the upper Peace cover much less area than those of coarser materials, and are usually found where local eddy currents have produced temporarily or partially ponded conditions on the banks of the river. These banks are often steep and badly washed out, but they develop a vegetation very quickly which tends to hold them. The commonest species on damp sandy-muddy banks is *Equisetum variegatum* which often forms pure stands and is undoubtedly a potent factor in stabilizing the soil. Other species which are common though of secondary importance are:

<i>Selaginella selaginoides</i>	<i>Carex Hassei</i>
<i>Equisetum palustre</i> (dominant in some places)	<i>Carex capillaris</i>
<i>Poa alpina</i>	<i>Juncus arcticus</i>
<i>Carex eburnea</i>	<i>Allium Schoenoprasum</i>
<i>Carex aurea</i>	var. <i>sibiricum</i>
	<i>Tofieldia palustris</i>

Polygonum viviparum  
Anemone parviflora  
Fragaria glauca  
Prunella vulgaris  
var. lanceolata

Erigeron glabellus  
Achillea borealis  
Senecio pauperulus

Drier shores, usually of sand, have an open growth of grasses among which *Deschampsia cespitosa* var. *glaucia*, *Calamagrostis canadensis* var. *robusta*, and *Agropyron trachycaulum* var. *typicum* are most important.

There is usually a rather abrupt transition from these sandy and muddy shores to the neighboring forest, with only a marginal shrubby growth of *Alnus incana*, *Cornus stolonifera*, and *Salix* spp.

More complicated developmental processes in the flood plain forest are found in abandoned or otherwise modified stream channels where slough vegetation plays a part. A more or less detailed description of such a place will serve to characterize this type of succession. About 6 miles below the mouth of the Wicked River a small stream which comes from the mountains to the north enters the lowland and pursues a winding course across a local flood plain. It has been dammed in two or three places by beavers, forming ponds, and at the time the observations were made (late July), although the ponds were full, the small drainage stream, about a foot wide, was traversing a mud flat for a short distance to finally seep away without reaching the main river. The area below the ponds therefore has a wet meadow vegetation hemmed in by the forest on one side and steep rock slides on the other. Figure 3 is a diagrammatic section of this meadow. The small stream has no aquatic plants but on its muddy borders there is an occasional individual of *Ranunculus sceleratus*.

#### *Potamogeton* ASSOCIATION:

This area was evidently under water not long before the notes were made. The pondweed, *P. gramineus* var. *graminifolius*, remained only in a semi-dessicated condition, creeping on the damp mud, while *Juncus alpinus*, *Juncus nodosus*, and *Equisetum limosum* seemed to be colonizing rapidly. *Rorippa palustris* var. *glabrata* is occasional, having a "sickly" appearance, its inflorescences contracted into reddish fasciculate masses.

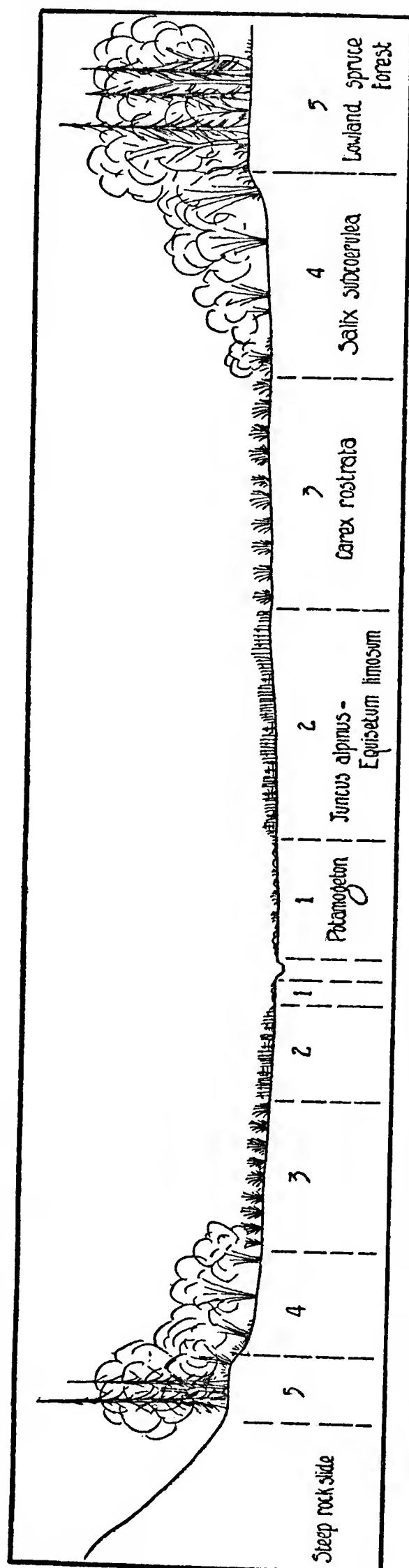


FIGURE 3. DIAGRAMMATIC SECTION OF A LOWLAND MEADOW ABOUT 6 MILES BELOW THE WICKED RIVER.

*Juncus alpinus* — *Equisetum limosum* ASSOCIATION:

A broad band on either side of the stream is clearly dominated by thick stands of these species. With them are *Alopecurus aequalis*, *Juncus nodosus*, *Rorippa palustris*, and a few plants coming from the next associations — *Salix subcoerulea* (young shoots), *Carex rostrata*, and *Glyceria striata* var. *stricta*.

*Carex rostrata* ASSOCIATION:

The dense growth of this sedge with its bright green color clearly designates the association. *Rorippa palustris* var. *glabrata* and a few young shoots of *Salix subcoerulea* are the only plants which break its continuity. Between it and the preceding, however, there are transitions in some places which involve species not listed above. On slightly drier ground *Carex flava*, *Carex lenticularis*, *Carex Bebbii*, and *Agrostis scabra* are prominent, while in wetter places the *Glyceria* becomes abundant.

*Salix subcoerulea* ASSOCIATION:

In places this willow forms a nearly pure stand, but in others is mixed with *Alnus incana*. At the immediate margin of the slough, in the partial shade of the willows, *Calamagrostis canadensis* var. *robusta*, *Veronica americana*, *Rorippa palustris* var. *glabrata*, and *Ranunculus Macounii* are common. Narrow abandoned channels show a stage between this and the neighboring forest, with a thicket of *Alnus incana* under which are *Pteretis nodulosa*, *Athyrium Filix-femina*, *Cardamine pensylvanica*, *Carex pachystachya*, and *Carex retrorsa*.

The flood plain forest itself has some striking differences from that of higher levels. It lacks much of the thick mat of mosses, and the shrub layer is more dense with nearly impenetrable thickets of *Cornus stolonifera*, *Alnus crispa*, *Viburnum pauciflorum*, and last but not least, *Oplopanax horridum*. The white birches reach large size in this timber. Other abundant species are *Athyrium Filix-femina*, *Thelypteris spinulosa* var. *dilatata*, *Thelypteris Dryopteris*, *Equisetum pratense*, *Cinna latifolia*, *Streptopus amplexifolius*, *Epipactis repens*, *Actaea rubra*, and *Circaealpina*.

Most cabin clearings are made in the timber of the immediate river banks, so that plants which appear as weeds are mainly those of the meadows, shores, and waste places at low elevations throughout the region. Also, to facilitate boat landings and

make the hinterland more accessible, sites are usually chosen at the mouths of tributary streams along the larger rivers where there are gravel or sand bars. Thus the weed flora draws freely from the somewhat varied natural habitats of these situations as described above.

In the clearings at the base of Mt. Selwyn there are alternating patches of shrubs and small grassy meadows. In the former, *Rosa acicularis*, *Elaeagnus argentea*, *Rubus idaeus* var. *canadensis*, with small trees from the neighboring forest make up the cover. In the meadows *Hierochloë odorata*, *Bromus Pumellianus*, *Elymus innovatus*, *Poa pratensis*, and *Agropyron trachycaulum* var. *unilaterale* are the principal grasses, while the ubiquitous fireweed, *Epilobium angustifolium*, and the goldenrod, *Solidago canadensis*, are very common among the other herbs. A fairly representative list of the remainder of the weed flora is as follows. Comparison with the above lists of natural vegetation will show clearly that very few plants from the outside world are present.

<i>Bromus ciliatus</i>	<i>Galium triflorum</i>
<i>Poa palustris</i>	<i>Galium boreale</i>
<i>Poa alpina</i>	<i>Aster foliaceus</i>
<i>Phleum pratense</i>	<i>Aster Richardsonii</i>
<i>Arctagrostis arundinacea</i>	<i>Erigeron acris</i> var. <i>asteroides</i>
<i>Cinna latifolia</i>	<i>Petasites palmatus</i>
<i>Chenopodium capitatum</i>	<i>Taraxacum lacerum</i>
<i>Geum strictum</i>	<i>Hieracium canadense</i>
<i>Epilobium glandulosum</i> var. <i>adenocaulon</i>	

The introduction of garden plants has greatly increased this flora in some places, but no further accurate notes have been made.

#### MUSKEG VEGETATION IN THE CORDILLERAN REGION

The mountain topography in the vicinity of the Peace River Pass is in a fairly mature stage so that nearly all of the land surfaces are well-drained and on slopes of varying steepness. As a result marshes and bogs, depending for their existence upon lack of drainage, are not common. None at all were encountered upon the scene of the expedition's activities near Mt. Selwyn with the exception of the flood plain sloughs already described; but the muskeg visited along Carbon River on August 2nd yielded con-

siderable data toward an understanding of these habitats. This was supplemented by notes on some pot-hole sloughs and bogs near the western end of the Rocky Mountain Portage made next day.

An old Indian trail follows the west bank of Carbon River. By leaving it about 4 miles above the Peace, crossing the stream, and ascending a 40—50-foot rocky cliff, a comparatively level bench-land is reached which carries a bog forest of black spruce.

#### PRIMARY SPP.:

<i>Picea mariana</i>	<i>Carex interior</i>
<i>Betula glandulosa</i>	<i>Sphagnum</i> sp.

#### SECONDARY SPP.:

<i>Equisetum arvense</i>	<i>Salix brachycarpa</i>
<i>Equisetum variegatum</i>	<i>Salix fallax</i>
<i>Triglochin palustre</i>	<i>Geocaulon lividum</i>
<i>Glyceria striata</i>	<i>Drosera rotundifolia</i>
var. <i>stricta</i>	<i>Parnassia fimbriata</i>
<i>Calamagrostis inexpansa</i>	<i>Rosa acicularis</i>
var. <i>brevior</i>	<i>Empetrum nigrum</i>
<i>Scirpus cespitosus</i>	<i>Viola nephrophylla</i>
var. <i>callosus</i>	<i>Epilobium palustre</i>
var. <i>monticola</i>	var. <i>monticola</i>
<i>Eriophorum viridicarinatum</i>	<i>Moneses uniflora</i>
<i>Carex gynocrates</i>	<i>Pyrola asarifolia</i>
<i>Carex leptalea</i>	var. <i>incarnata</i>
<i>Carex Hassei</i>	<i>Ledum groenlandicum</i>
<i>Carex capillaris</i>	<i>Chiogenes hispidula</i>
<i>Carex vaginata</i>	<i>Arctostaphylos rubra</i>
<i>Tofieldia glutinosa</i>	<i>Vaccinium Vitis-Idaea</i>
<i>Orchis rotundifolia</i>	var. <i>minus</i>
<i>Habenaria hyperborea</i>	<i>Menyanthes trifoliata</i>
<i>Spiranthes Romanzoffiana</i>	<i>Galium boreale</i>
<i>Salix myrtillifolia</i>	

The spruces are 6—10 inches in diameter, arranged in an open woods with hummocks of *Sphagnum* between. Depressions are usually wet, with some standing water, and it is in these that the carices are abundant. In small areas tussocks of *Scirpus* make up most of the cover. The *Sphagnum* hummocks form the bases for the scattered shrub cover and the further development of the

timber. *Ledum groenlandicum* is next in importance to *Betula glandulosa* in wetter areas; but at the drier margins where the neighboring steep slopes of the mountain rise, roses and the other shrubs of the rich spruce woods are predominant.

The pot-holes near the western end of the Rocky Mountain Portage are on a bench-land perhaps 2—300 feet above the river, near the base of the Butler Ridge, and about 3 miles northeast of the head of the canyon. They show a variety of shapes, sizes, and stages of filling — some with sedge sloughs and others with a mossy cover suggestive of "high moor". Two of these, one of each kind, will be described in some detail.

Figure 4 shows a generalized section of a sedge slough in which a small pond remains. The water had evidently receded, shortly before the observations were made, from the area of the *Sagittaria* association, leaving a very wet and soft black muck of considerable depth. The water carries very little macrophytic vegetation, but at the margins there was a small amount of *Potamogeton pusillus* var. *mucronatus* accompanied by a few plants of *Sagittaria*.

#### *Sagittaria* ASSOCIATION:

At the time it was examined this zone was so wet that one could scarcely walk over it except at the outer margin. In order to reach the pond it was necessary to throw down a bridgework of trees and branches. The arrow-leaf makes a remarkably thick and nearly pure stand, with many of its fleshy leaves flattened against the muck. It was in full bloom. *Potamogeton natans* (creeping on the mud) and *Epilobium glandulosum* var. *adenocaulon* were occasional, the latter at the outer margin.

#### *Alopecurus* — *Glyceria* ASSOCIATION:

Separating the open pond from the border bands of wet meadow sedges is a narrow zone, averaging about 2 yards in width, composed of several species about equal in abundance. There is a rough but rather consistent banding of these in such a way that *Alopecurus aequalis*, which comes nearest the shore, is separated from the outer *Glyceria borealis* by a narrow but conspicuous stand of *Agrostis scabra*, clearly showing by its filmy inflorescences. Variations occur when the two outer bands are absent and *Glyceria* comes down to the mud flat, or when none of the three appears and their place is taken by a dense growth of

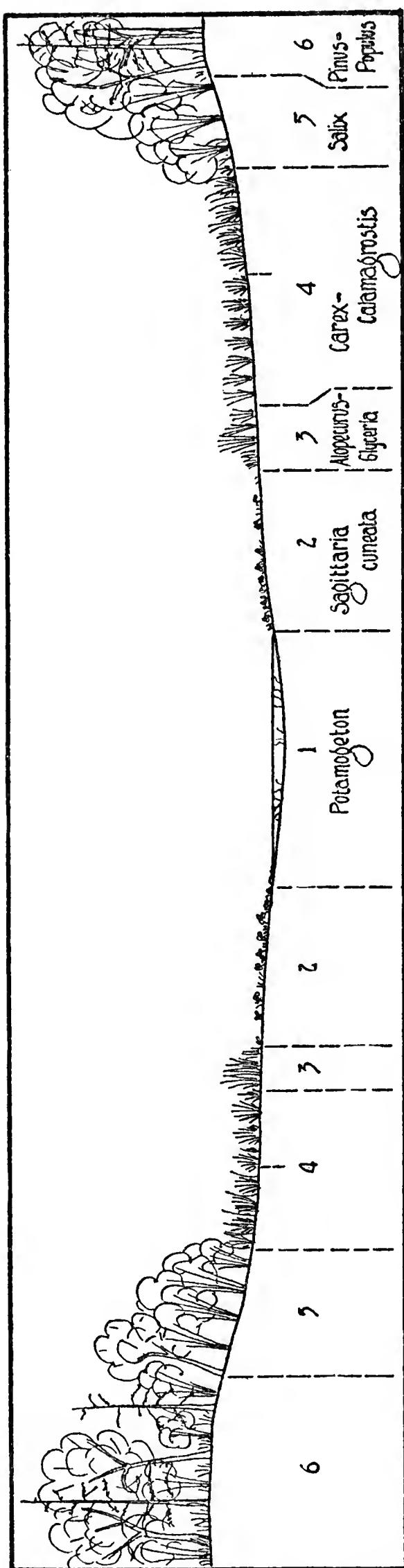


FIGURE 4. SECTIONAL DIAGRAM OF A SEDGE SLOUGH NEAR THE WESTERN END OF ROCKY MOUNTAIN PORTAGE.

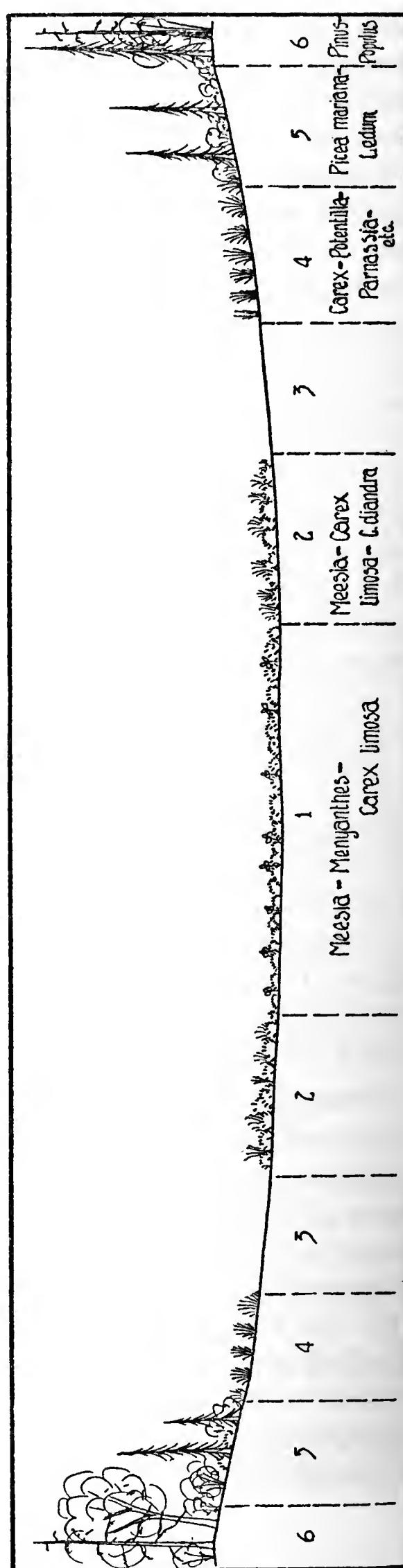


FIGURE 5. SECTIONAL DIAGRAM OF A MOSSY SLOUGH NEAR THE WESTERN END OF ROCKY MOUNTAIN PORTAGE.

*Eleocharis palustris*. A few secondary species are scattered here and there: *Epilobium glandulosum* var. *adenocaulon*, *Carex Crawfordii*, and *Carex rostrata*. This lack of continuity in the vegetation at immediate slough margins is of regular occurrence throughout the region. Wet meadow vegetations, on the other hand, are inclined to be stereotyped, the same species being common to nearly all sloughs.

#### *Carex — Calamagrostis* ASSOCIATION:

The wet meadow varies in width with the slope. Its lower parts are covered by a dense growth of *Carex rostrata*, with which there are scattered plants of *Calamagrostis canadensis* var. *robusta*, *Equisetum arvense*, *Polygonum natans*, *Stellaria borealis*, *Potentilla norvegica* var. *hirsuta*, and *Epilobium glandulosum* var. *adenocaulon*. Near the willow margin the bluejoint grass becomes predominant, making a rich meadow, and gradually disappears in the clumps of *Salix planifolia* and *Salix Bebbiana*. *Agrostis scabra*, *Polygonum natans*, *Potentilla palustris*, and *Geum macrophyllum* var. *perincisum* are of secondary importance.

#### *Salix* ASSOCIATION:

The willows make close shrubbery around the whole depression and are associated with *Alnus crispa*, *Betula papyrifera*, *Equisetum pratense*, *Epilobium angustifolium*, and other mesophytic herbs. They merge directly into the rather dry pine-poplar woods of the bench-lands.

Another pot-hole had no open water in it, but a very wet boggy center in which mosses formed a large part of the cover. Figure 5 is a generalized section of it. The primary species of the central portion are *Menyanthes trifoliata*, *Carex limosa*, and the moss (*Meesia* sp.). The surface of the moss has a dessicated appearance but the whole is steeped in water just beneath. Toward the edges a sedge, *Carex diandra*, takes the place of *Menyanthes*, forming tussocks. Surrounding this boggy center is a strip which is nearly barren of living vegetation. The surface is composed of dead plant parts and looks as if it had recently been submerged.

Beyond the barren strip is a rather open meadow association involving some of the marginal species of both muskegs and wet meadows. The most prominent are *Carex trichocarpa* var. *aristata*, *Potentilla palustris*, *Potentilla norvegica* var. *hirsuta*, *Stellaria longifolia*, *Parnassia montanensis*, *Castilleja* sp., and mosses.

Finally, at the outer margin of the depression, muskeg forest prevails, dominated by *Picea mariana*, *Ledum groenlandicum*, and mosses growing in hummocks. The general impression gained from this association complex is that of a slough which is in the later stages of invasion by mosses and other plants of the muskeg or "high moor". The invasion appears to take place marginally and by the growth of heavy moss mats in the center of the pond. The writer has reported a similar arrangement in a muskeg along upper Salt River near Pine Lake, in the Wood Buffalo Park (85). We saw the one on the upper Peace near the close of a very dry summer when the pond had dried so much that the bottom was everywhere exposed, and that part near the margin which was open water before had become entirely barren.

Between these two kinds of pot-hole vegetation there were several intergrading types in the vicinity. Taken together they appear to outline the main stages in the filling of ponds and the development of such muskeg timber as that seen along Carbon River. The causes for the invasion of certain sloughs by mosses, and not of others, are still obscure. Sedge sloughs develop wet grassy meadows which are in turn invaded by willows and finally by mesophytic timber. Other ponds produce great masses of moss as a foundation for muskeg shrubs and trees, in part or completely eliminating the ordinary slough grasses and sedges in the process. Two facts regarding this vegetation are of outstanding significance. First, among the slough and wet muskeg plants proper, involving some 75 species, there are no strictly cordilleran plants; all are of wide range in the central part of the Mackenzie basin, and nearly all extend eastward to the St. Lawrence basin. *Parnassia fimbriata* and *Carex pachystachya*, though listed in the above descriptions, are both extreme marginal plants which are somewhat doubtfully included. The well-developed muskeg forest along Carbon River has only two species which may be regarded as cordilleran: *Salix brachycarpa* and the newly described *Salix fallax* (see p. 149). Second, the general structure and arrangement of the associations, as well as the apparent courses of the successions, are identical with those of similar habitats elsewhere in the central and southern parts of the Mackenzie basin or farther eastward. Whether these conclusions will hold after further examination of mountain muskegs and marshes remains to be seen. At least it makes still more evident the close

relationship between the cordilleran forest of the Peace River valley and that of the central plain to the east.

### THE FORESTS OF THE INTERIOR PLAIN

Reference has already been made to the problem of establishing a boundary between the cordilleran and interior coniferous forests. The writer's personal knowledge of the latter is limited to studies in the Hudson Hope district, casual observations on the plateau between Dawson Creek and Fort St. John, collections along the river about 10 miles above Carcajou Settlement, and his work in the Wood Buffalo Park (83, 85). In the Carcajou district the upland forest was not examined extensively. The most reliable of the early sources of information are the writings of John (54, 57) and J. M. Macoun, G. M. Dawson (20), William Ogilvie (75, 76, 77) and R. G. McConnell (51, 52). In more recent years the collections of A. H. Brinkman, and personal communications to the writer from Dr. E. H. Moss of the University of Alberta have been of value in this connection. When all of the material is weighed we find that detailed knowledge is yet lacking of the upland forests in the Peace River drainage between the Hudson Hope district and the country below Vermilion Chutes. However, the travellers mentioned above have been rather keen and accurate observers, so that their descriptions of the forests may be taken as reliable; and there is no indication in them of any break in the essential continuity, with the exception of the jack and lodgepole pines, of a single group of forest trees. *Picea glauca*, *P. mariana*, *Larix laricina*, *Populus tacamahaca*, *Populus tremuloides*, and *Betula papyrifera* or its varieties occur throughout, while *Pinus contorta* var. *latifolia* and *Pinus Banksiana* have been regarded as characteristic of the upper and lower Peace respectively.

As noted above, the lodge-pole pine has been found on the Caribou Mountains, but whether this is an isolated outlier or part of a long and straggling range extension is not known. Information on the higher plateaus of the whole region is still very scanty. Also, whether there are outliers of the jack pine on the upper Peace is uncertain. Dr. Moss regarded all of the pines which he saw on a trip through the agricultural districts and north of Fort St. John as far as the Notikewin as lodge-pole. Other cordilleran

trees of the upper Peace have not been noted so far to the north-eastward. Dawson's somewhat doubtful record of *Picea Engelmanni* southeast of Fort St. John is not verified, and none of the observers have recorded *Abies lasiocarpa* east of the mountains. In the Lesser Slave Lake district, which constitutes part of the height of land between the Peace and Athabaska basins, John Macoun many years ago found *Abies lasiocarpa* and other cordilleran plants. The fact that this region carries an eastern extension of the mountain forests is well substantiated by Brinkman's collections of 1928—29 in which there are many cordilleran species. How far northeastward this goes, and whether it is to be found on the uplands between the lower Peace and lower Athabaska is yet to be learned. The increasingly boreal nature of the cordilleran forests north of the Peace River (22) would suggest that similar extensions eastward in that region are not to be expected.

In spite of the general continuity of the Peace River forests there are many differences when the total woodland flora is considered. The following lists will suggest these differences.

#### WOODLAND SPECIES FOUND THUS FAR ONLY WEST OF HUDSON HOPE:

<i>Athyrium Filix-femina</i>	<i>Geranium Richardsonii</i>
<i>Woodsia scopulina</i>	<i>Acer glabrum</i> var. <i>Douglasii</i>
<i>Abies lasiocarpa</i>	<i>Olopanax horridum</i>
<i>Streptopus amplexifolius</i>	<i>Chimaphila umbellata</i>
<i>Clintonia uniflora</i>	<i>Chiogenes hispidula</i>
<i>Veratrum Eschscholtzianum</i>	<i>Rhododendron albiflorum</i>
<i>Corallorrhiza maculata</i>	<i>Arctostaphylos Uva-ursi</i> var. <i>adenotricha</i>
<i>Listera cordata</i>	<i>Vaccinium membranaceum</i>
<i>Epipactis decipiens</i>	<i>Pedicularis bracteosa</i>
<i>Betula papyrifera</i> var. <i>occidentalis</i>	<i>Lonicera involucrata</i>
<i>Aconitum delphinifolium</i>	<i>Sambucus pubens</i>
<i>Ribes laxiflorum</i>	<i>Valeriana sitchensis</i>
<i>Parnassia fimbriata</i>	<i>Senecio lugens</i>
<i>Tiarella unifoliata</i>	<i>Hieracium gracile</i>
<i>Aruncus acuminatus</i>	<i>Hieracium albiflorum</i>
<i>Sorbus dumosa</i>	

WOODLAND SPECIES FOUND THUS FAR AT OR BELOW HUDSON  
HOPE, BUT NOT IN THE WOOD BUFFALO PARK:

<i>Botrychium virginianum</i>	<i>Prunus demissa</i>
var. <i>europaeum</i>	<i>Spiraea lucida</i>
<i>Pinus contorta</i> var. <i>latifolia</i> <sup>1</sup>	<i>Osmorhiza obtusa</i>
<i>Habenaria orbiculata</i>	<i>Vaccinium caespitosum</i>
<i>Salix subcoerulea</i>	<i>Castilleja</i> sp.
<i>Corylus cornuta</i>	<i>Aster conspicuus</i> <sup>1</sup>
<i>Thalictrum occidentale</i>	<i>Arnica cordifolia</i>
<i>Clematis verticillaris</i>	
var. <i>columbiana</i>	

These lists are not complete for all of the habitat variations in the rich woodlands, but they indicate the main trends. The relatively small number in the second points to the Hudson Hope district just east of the mountains as a major demarcation region. Examination of the woodlands of the Wood Buffalo Park shows no species which do not range throughout the Peace valley with the possible exception of the jack pine; and it is of further interest that there are very few of the species in the second list which do not occur, so far as is known, farther westward in the valley (possibly *Corylus cornuta* and *Prunus demissa*). It seems clear therefore that there are no important differences in the three broad divisions other than the elimination of species progressively from west to east.

#### UPLAND SPRUCE FORESTS

At Hudson Hope a ravine in the high river bluff north of the town was found to have a nearly virgin timber. It is at an elevation of about 2000 feet, near the level of the central plain in this locality. Figure 6 is a diagrammatic section of the vegetation.

#### PRIMARY SPP.:

<i>Picea glauca</i>	Woodland mosses
<i>Alnus crispa</i>	

#### SECONDARY SPP.:

<i>Equisetum arvense</i>	<i>Carex concinna</i>
<i>Equisetum scirpoides</i>	<i>Maianthemum canadense</i>
<i>Carex disperma</i>	var. <i>interius</i>
<i>Carex Richardsonii</i>	<i>Cypripedium passerinum</i>

<sup>1</sup>Found on the lower river only on the Caribou Mountains.

Habenaria obtusata	Rosa acicularis
Habenaria orbiculata	Epilobium angustifolium
Listera borealis	Cornus canadensis
Corallorrhiza trifida	Cornus stolonifera
Salix arbusculoides	Moneses uniflora
Populus tacamahaca	Pyrola chlorantha
Populus tremuloides	Pyrola asarifolia
Betula papyrifera	Mertensia paniculata
Alnus incana	Linnaea borealis var. americana
Geocaulon lividum	Viburnum pauciflorum
Mitella nuda	Aster conspicuus
Ribes oxyacanthoides	Aster Lindleyanus
Ribes triste	Petasites palmatus
Rubus pubescens	

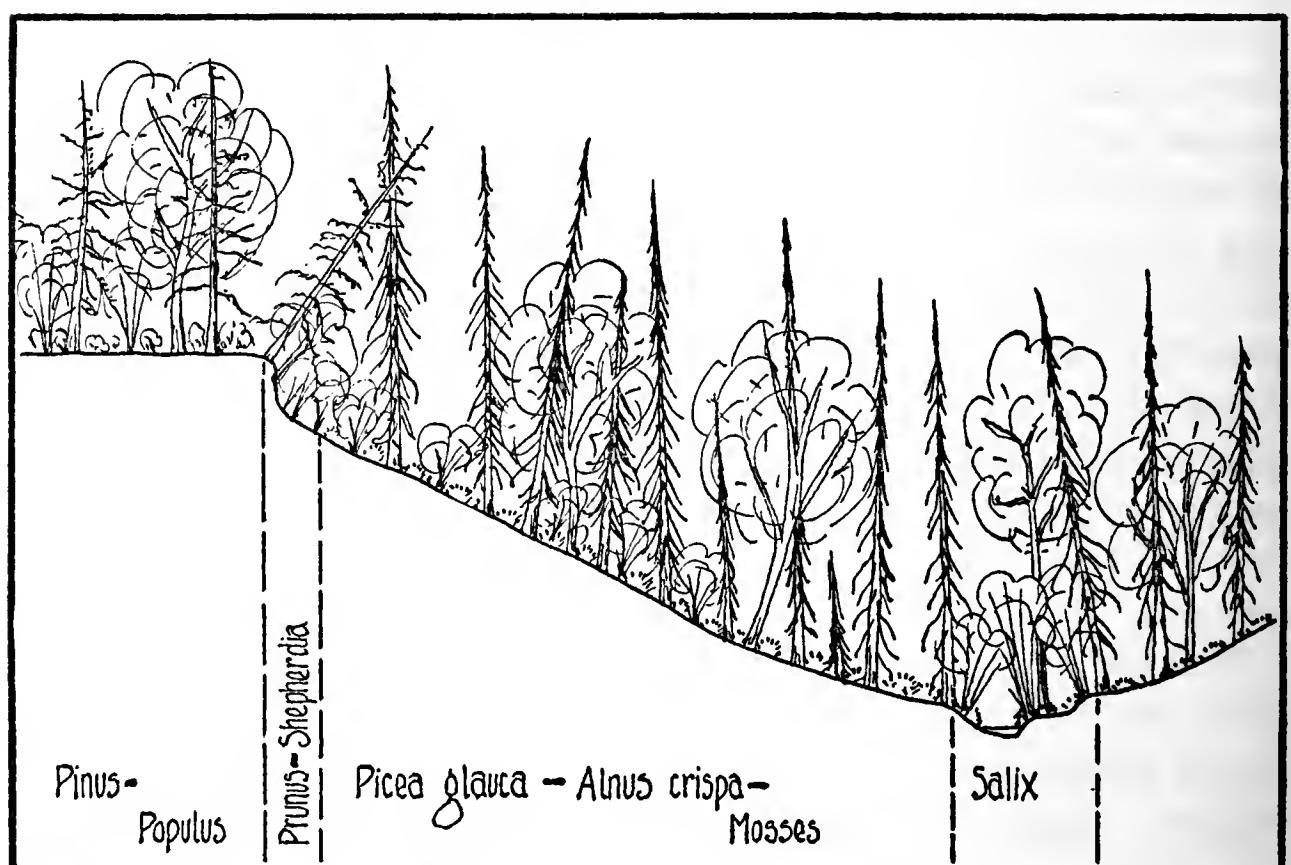


FIGURE 6. SECTION OF THE VEGETATION IN A RAVINE NORTHWEST OF HUDSON HOPE.

The ravine carries a small stream of clear water with accompanying marginal vegetation. Most of the balsam poplars and willows are near the water, as are also *Glyceria striata* var. *stricta*, *Eriophorum opacum*, and thick turfs of *Carex disperma*. Drier slopes have a mat of *Arctostaphylos Uva-ursi* among the

mosses, while at the rim of the ravine there is a considerable infusion of species from the surrounding burnt-over pine woods. The steep bank at the top has a more or less dense thicket of *Prunus demissa* and *Shepherdia canadensis*. The spruces in some places form nearly pure stands with a thick undergrowth of *Alnus*. A tree 90 feet high and 15 inches in diameter 2 feet from the base proved to be 95 years old. Three other rich woodland species found in the Hudson Hope district but not listed above are *Clematis verticillaris* var. *columbiana*, *Arnica cordifolia*, and *Osmorhiza obtusa*. In vegetational structure there is a close resemblance between these woods and most of those on the uplands in the Wood Buffalo Park.

Another type of upland forest has been described in the Wood Buffalo Park (85). On high morainic ridges there is a very open park-like spruce wood in which the undergrowth is exceedingly sparse, and the ground cover is of xerophytic lichens and trailing heath mats. It resembles in general aspect the drier pine woods, but with the pines replaced by white spruce. Whether this type is represented on the upper Peace is as yet unknown. It has been suggested that in the Wood Buffalo Park this timber is an old one, dating back to the first arrival of the trees after the deposit and exposure of the moraines. The lower slopes of the hills and the more or less level sand plains probably acquired the open jack pine timber by invasion at a later time. A spruce wood of similar nature has been found on the sand plains near the northeastern limit of tree growth, and near the extreme limit of the range of the jack pines (82).

#### THE PINE WOODS

The lodge-pole pine woods in the Hudson Hope district are mainly found on uplands, the surface materials of which are usually of sandy or gravelly morainic deposits, or of other very well-drained soils. As elsewhere in the upper part of the MacKenzie basin the pine woods display a variety of developmental stages which appear to culminate in the more mesophytic forest of white spruce. The following list has been composed from notes made on both sides of the Peace and in woods of different stages. It would serve almost equally well for the pine woods of the Wood Buffalo Park, with the pines interchanged.

## PRIMARY SPP.:

Trees—	<i>Pinus contorta</i> var. <i>latifolia</i>	Very dry woods south of the Peace River.
Shrubs—	<i>Rosa acicularis</i>	
	<i>Shepherdia canadensis</i>	
Ground—	<i>Arctostaphylos Uva-ursi</i>	
	<i>Elymus innovatus</i>	Rich pine woods north of the river.
	<i>Peltigera aphthosa</i>	
Trees—	<i>Pinus contorta</i> var. <i>latifolia</i>	
Shrubs—	<i>Alnus crispa</i>	
Ground—	<i>Vaccinium Vitis-Idaea</i> var. <i>minus</i>	Wood land mosses

## SECONDARY SPP.:

<i>Equisetum scirpoides</i>	<i>Amelanchier florida</i>
<i>Picea glauca</i>	<i>Fragaria glauca</i>
<i>Larix laricina</i>	<i>Hedysarum alpinum</i>
<i>Festuca ovina</i>	var. <i>americanum</i>
<i>Oryzopsis pungens</i>	<i>Lathyrus ochroleucus</i>
<i>Oryzopsis asperifolia</i>	<i>Vicia americana</i>
<i>Calamagrostis purpurascens</i>	<i>Pyrola asarifolia</i>
<i>Carex siccata</i>	var. <i>incarnata</i>
<i>Carex Richardsonii</i>	<i>Pyrola secunda</i>
<i>Maianthemum canadense</i>	<i>Pyrola chlorantha</i>
var. <i>interius</i>	<i>Ledum groenlandicum</i>
<i>Habenaria viridis</i>	<i>Mertensia paniculata</i>
var. <i>bracteata</i>	<i>Galium boreale</i>
<i>Corallorrhiza trifida</i>	<i>Solidago oreophila</i>
<i>Populus tremuloides</i>	<i>Aster conspicuus</i>
<i>Salix Bebbiana</i>	<i>Aster Lindleyanus</i>
<i>Betula papyrifera</i>	<i>Antennaria Howellii</i>
<i>Anemone multifida</i>	<i>Achillea Millefolium</i>
var. <i>hudsoniana</i>	<i>Arnica cordifolia</i>
<i>Spiraea lucida</i>	<i>Hieracium canadense</i>

Both of the pine woods areas studied near Hudson Hope are on the plain which lies near the 1600-foot level. South of the river this is a very gently rolling country with gravelly soils; but northeast of the town most of the pine is on sandy morainic ridges. In the former the larger pines are about 35 years old, but an aspen in the same woods proved to be 60 years old, indi-

cating that aspens may have preceded the pines following the last serious burn. Most of the trees have fire scars at the base. On the ridges north of the river the forest seems to have been undisturbed for a longer time and has a much more mesophytic vegetation as the above lists show.

The lodge-pole pine found on the Caribou Mountains has been described by the writer elsewhere (85). It is notable because it is in some places associated with black spruce in such a way that the spruce appears to have invaded and crowded it out. The resulting black spruce forest is very dense and has a rich ground cover of mosses. On dry knolls the pines are associated with white birch and white spruce in an open park-like timber.

#### MUSKEG AND LOWLAND FORESTS

Muskeg forest, so far as is known, is practically uniform throughout the region. It has been shown previously that the Carbon River muskeg closely resembles those of the Wood Buffalo Park both structurally and floristically, and although the writer had no opportunity to examine any in the Hudson Hope district, current knowledge of the region indicates no variation from the type. *Picea mariana* is the predominating tree and *Ledum groenlandicum* is most abundant in the shrub cover. A thick mat of woodland mosses in which *Sphagnum* plays an important part in wetter areas makes up most of the ground cover. *Larix laricina*, although common, is never of primary position in the association. The scattered secondary species are composed of a few plants characteristic of muskegs, and many which come from the rich coniferous woods of the uplands.

Most river flood plains of long standing and good drainage develop a rather heavy timber of white spruce which resembles superficially the upland spruce woods. It has relatively more undergrowth, however, and its ground cover usually has a much thinner accumulation of mosses and humus.

#### PRIMARY SPP.:

*Picea glauca*  
*Populus tacamahaca*  
*Salix Bebbiana*

*Viburnum pauciflorum*  
*Cornus stolonifera*

## SECONDARY SPP.:

<i>Equisetum pratense</i>	<i>Lathyrus ochroleucus</i>
<i>Maianthemum canadense</i>	<i>Astragalus frigidus</i>
var. <i>interius</i>	var. <i>americanus</i>
<i>Alnus incana</i>	<i>Shepherdia canadensis</i>
<i>Geocaulon lividum</i>	<i>Cornus canadensis</i>
<i>Actaea rubra</i>	<i>Pyrola asarifolia</i>
<i>Ribes oxyacanthoides</i>	<i>Pyrola asarifolia</i>
<i>Ribes hudsonianum</i>	var. <i>incarnata</i>
<i>Ribes triste</i>	<i>Pyrola secunda</i>
<i>Rosa acicularis</i>	<i>Pyrola chlorantha</i>
<i>Rubus pubescens</i>	<i>Moneses uniflora</i>
<i>Rubus idaeus</i> var. <i>canadensis</i>	<i>Mertensia paniculata</i>
<i>Fragaria glauca</i>	<i>Galium boreale</i>
<i>Fragaria vesca</i>	<i>Linnaea borealis</i>
var. <i>americana</i>	var. <i>americana</i>
<i>Vicia americana</i>	<i>Aster Lindleyanus</i>

The absence of primary species in the ground cover, and the prominence of shrubs among both primary and secondary species are characteristic of this timber. Comparison with lowland forests in the mountains, however, shows notable differences. *Betula papyrifera*, *Alnus crispa*, *Oplopanax horridum*, *Athyrium Filix-femina*, *Thelypteris spinulosa* var. *dilatata*, *Thelypteris Dryopteris*, and *Streptopus amplexifolius*, though rather common in the latter, are occasional or entirely absent farther down stream.

The stages of development in the lowland forest appear, in general, to be functions of the rate of the current and hence of its rate and manner of deposit. The gravel bars and steep muddy-sandy banks in the mountains have already been described. Not far east of the mountains the current rapidly diminishes in strength, while sand and mud bars replace those of gravel and boulders. This change introduces a different set of early stages in the genesis of the lowland timber. The sandbar willow, *Salix interior* var. *pedicellata*, becomes the pioneer plant. On higher ground, stabilized by the ramifying roots of this plant, there comes a balsam poplar wood which passes through a stage when it is nearly pure, with not much undergrowth and scarcely any ground cover. Other willows such as *Salix lutea*, *Salix Macken-*

*ziana*, *Salix arbusculoides*, and *Salix Bebbiana* commonly occur in the transition to the poplar, and *Salix Bebbiana* usually remains in the timber. Probably the commonest herbaceous plant in the poplar woods is *Equisetum pratense*. White spruce soon starts up in the thick poplar wood and eventually dominates it. A common lowland forest type therefore consists of a thick and vigorous spruce stand with here and there some very old poplars of enormous size, their great boles free of branches 50 feet or more above the ground. The crash of their falling is not uncommonly heard, preceded by a loud snap when their rotten trunks break off near the top.

#### BURNED TIMBER

Although the matter was not investigated extensively, there is no reason to believe that the influence of fire in the upland forests differs from that on the lower Peace. Rich woods tend to return to a normal state very soon if the burn is slight, but if it is intense there is a large infusion of *Populus tremuloides* which may form pure stands. Undergrowth in this aspen wood is relatively thick, with *Salix Bebbiana*, *Rosa acicularis*, *Amelanchier florida*, and *Symphoricarpos albus* var. *pauciflorus* the most prominent shrubs. Many herbaceous species of the semi-open prairies find their way into the association. Here again there is a close resemblance between the woodlands of the upper and lower Peace. Further notes on the aspen woods will be found in the discussion of the semi-open country.

In concluding this brief sketch of the interior forests the scarcity of our current knowledge should be stressed again. As noted above, a prominent extension of the distinctly cordilleran timber occurs on the height of land between the Athabaska and Peace Rivers where it probably intergrades with eastern fir-spruce forests. Whether the other highlands bordering the Peace have similar extensions is yet to be determined.

#### THE SEMI-OPEN PRAIRIES

Semi-open prairie lands are of wide distribution in the central and southern parts of the Mackenzie basin. The early travellers on the Peace were aware only of those on the immediate banks of the rivers, and many years passed before adequate descriptions of even the larger openings such as those of Grande Prairie were written. The Salt Plains west of the Slave River were known in

early times because the neighboring brine springs supplied salt for traders and travellers. The narrative of nearly every exploring expedition through this part of the country tells of a trip up Salt River through the plains for this purpose. The northern extent of the prairies is imperfectly known, but we have accounts of openings northwest of Great Slave Lake which have been described as similar to country south of the lake and west of the Slave River (86). Several travellers have described a semi-open country west of the Little Buffalo River, south of Great Slave Lake (11, 12, 79, 86), and the upland prairies of the southern part of the Wood Buffalo Park have recently been studied by the present writer (84, 85). Hulbert Footner saw similar country west of the Caribou Mountains between the Peace and Hay Rivers (28), while the central parts of the Peace River drainage are well known for the recent and rapid development of agriculture on land of this type. Southward, the Mackenzie basin openings, judging by present knowledge, are roughly separated from the park lands of central Alberta and Saskatchewan by the forest belt which covers a large part of the height of land between the Mackenzie and Saskatchewan watersheds. Their eastern margin seems to be the boundary of the crystalline rocks, but their western extent is not clearly known. It may reach to the base of the mountains and into the Liard valley. In general, the former range of the northern bison seems to conform to the distribution of the semi-open prairies (84).

Wherever they have been examined in detail the prairies occur on compact soils of a loamy character with surfaces even or very gently rolling, and with sufficient general slope to insure fairly good run-off. Where the physiographic development of the soils has been studied they have proven to be of lacustrine origin (83, 85)<sup>1</sup>. In the Wood Buffalo Park there are at least two sets of prairie lands, one on the exposed bottom of a post-Glacial lake which stands at about 1100 feet above sea-level, and another on a bottom at about 800 feet. These lakes appear to have been the last of a series which occupied the valley of the Peace and its

<sup>1</sup>It is of interest in this connection that several early students of the prairies in the middle western states considered them as closely related to the lacustrine origin of many of their soils. Lesquereux (49), Winchell (105) and others expressed this view in the 1860's, and recently Jones (43) has again raised the question with regard to the "Lake Chicago" region and some artificially drained lakes in Virginia. He holds that the rapidity of the drainage is an important factor in the development of the prairie.

tributaries during the retreat of the last Pleistocene ice. Great islands or headlands in these lakes, and subsequently barriers between semi-open areas, are the erosion plateaus of the Saddle, Birch, Clear, Buffalo Head and Cameron Hills, the Birch, Caribou, and probably the Horn Mountains. On the upper Peace these plateaus now separate some of the main settlements such as Grande Prairie and Spirit River.

The actual grasslands are usually of small area, interspersed with "poplar bluffs", patches of *Populus tremuloides* in a rather open wood. Some prairies at the eastern base of the Caribou Mountains are bordered by a spruce forest, suggesting that the aspen may have arisen after burning as it does in the other upland timber. Recent writers on this type of vegetation have called it "parkland", but for the Mackenzie basin the term is a bit ambiguous because so much of the upland timber has a park-like aspect although it may be quite different from the semi-open prairie country (82, 85).

In addition to the writer's own notes made at Hudson Hope, Taylor Flat, Dawson Creek, near Carcasson, and in the Wood Buffalo Park, he has used in the following account of the prairie flora notes made by John Macoun in 1875 (57), J. M. Macoun in 1903, and E. H. Moss in 1931. As in the case of the forests there are some species of the region above Vermilion which are unknown or rare in the Wood Buffalo Park, but whether there are any found in the latter place which do not occur in the former is as yet unknown since the prairie collections from the upper Peace are thus far incomplete. Nearly all of the species in the following list, however, are of southern range, and could be expected throughout the country above Vermilion. Those marked with an asterisk (\*) have not been found thus far in the Wood Buffalo Park.

D <sup>1</sup> . <i>Juniperus communis</i>	D. <i>Festuca ovina</i>
var. <i>montana</i>	*D. <i>Festuca brachyphylla</i>
D. <i>Juniperus horizontalis</i>	S. <i>Puccinellia Nuttalliana</i>
S <sup>1</sup> . <i>Triglochin maritimum</i>	D. <i>Poa glauca</i>
<i>Bromus ciliatus</i>	<i>Poa palustris</i>
<i>Bromus Pumpellianus</i>	<i>Poa nemoralis</i>

<sup>1</sup>"D" indicates species characteristic of very dry prairies; and "S" stands opposite plants of saline habitats.

- Poa pratensis
- S. Distichlis spicata
- Schizachne purpurascens
- D. Agropyron Smithii  
var. molle
- D. Agropyron trachycaulum  
var. typicum
- D. Agropyron trachycaulum  
var. unilaterale
- \*D. Agropyron dasystachyum
- Elymus Macounii
- Elymus innovatus
- D. Hordeum jubatum
- D. Koeleria cristata
- D. Avena Hookeri
- Avena fatua var. glabrata
- Deschampsia cespitosa  
var. glauca
- D. Danthonia intermedia
- Calamagrostis montanensis
- Calamagrostis canadensis  
var. robusta
- Calamagrostis inexpansa  
var. brevior
- D. Agrostis scabra
- Phleum pratense
- S. Muhlenbergia Richardsonis
- \*D. Oryzopsis micrantha
- D. Stipa comata
- D. Stipa comata  
var. intermedia
- \*D. Stipa viridula
- Stipa Richardsonii
- S. Spartina gracilis
- Hierochloë odorata
- D. Carex stenophylla
- D. Carex siccata
- \* Carex laeviculmis
- Carex praticola
- D. Carex obtusata
- \*D. Carex heliophila
- D. Carex abbreviata
- Carex Buxbaumii
- Carex atratiformis
- Carex trichocarpa  
var. aristata
- Juncus balticus
- Allium Schoenoprasum  
var. sibiricum
- \* Allium cernuum
- D. Smilacina stellata
- Sisyrinchium angustifolium
- Urtica gracilis
- D. Comandra pallida
- \* Chenopodium hybridum
- Chenopodium album
- Chenopodium leptophyllum
- S. Chenopodium rubrum
- Chenopodium lanceolatum
- S. Atriplex patula
- S. Atriplex patula  
var. hastata
- S. Salicornia europaea
- S. Suaeda depressa
- Stellaria longipes
- Stellaria longifolia
- D. Cerastium arvense
- S. Spergularia salina
- D. Lychnis Drummondii
- Delphinium scopulorum  
var. glaucum
- Anemone multifida  
var. hudsoniana
- Anemone cylindrica
- Pulsatilla ludoviciana

- Ranunculus rhomboideus
- S. Ranunculus Cymbalaria
- Thalictrum venulosum
- D. Draba nemorosa
- Erysimum cheiranthoides
- D. Erysimum parviflorum
- Arabis retrofracta
- Arabis hirsuta
- D. Heuchera Richardsonii
- Ribes oxyacanthoides
- Amelanchier florida
- Rubus idaeus
- var. canadensis
- Fragaria glauca
- Potentilla arguta
- D. Potentilla pulcherrima
- D. Potentilla pennsylvanica
- Potentilla Anserina
- Geum macrophyllum
- var. perincisum
- Geum strictum
- D. Geum triflorum
- Rosa acicularis
- Rosa Woodsii
- \* Prunus demissa
- Prunus pennsylvanica
- Astragalus frigidus
- var. americanus
- D. Astragalus adsurgens
- D. Astragalus hypoglottis
- \*D. Astragalus bisulcatus
- \*D. Astragalus aboriginum
- Astragalus eucosmus
- D. Astragalus tenellus
- \*D. Oxytropis retrorsa
- var. sericea
- \*D. Oxytropis spicata
- Oxytropis splendens
- Hedysarum alpinum
- var. americanum
- Vicia americana
- Lathyrus ochroleucus
- D. Linum Lewisii
- \*D. Malvastrum coccineum
- Viola adunca
- \*D. Opuntia polyacantha
- Elaeagnus argentea
- Epilobium angustifolium
- Epilobium palustre
- \* Sanicula marylandica
- Heracleum lanatum
- Arctostaphylos Uva-ursi
- Primula incana
- Dodecatheon pauciflorum
- S. Glaux maritima
- Gentiana elegans
- Lomatogonium rotatum
- \* Asclepias ovalifolia
- Collomia linearis
- Mertensia paniculata
- Stachys scopulorum
- D. Monarda mollis
- var. menthaefolia
- D. Orthocarpus luteus
- S. Plantago eriopoda
- S. Plantago oliganthos
- Galium boreale
- Lonicera glaucescens
- Symphoricarpos occiden-
- talis
- Symphoricarpos albus
- var. pauciflorus
- Valeriana septentrionalis
- Campanula rotundifolia
- D. Grindelia squarrosa
- Solidago canadensis
- D. Solidago oreophila
- Aster Lindleyanus
- D. Aster laevis var. Geyeri
- D. Aster ericoides

S. <i>Aster pauciflorus</i>	D. <i>Artemisia dracunculoides</i>
D. <i>Erigeron glabellus</i>	<i>Artemisia biennis</i>
<i>Erigeron philadelphicus</i>	D. <i>Artemisia frigida</i>
*D. <i>Erigeron caespitosus</i>	*D. <i>Artemisia Tilesii</i>
<i>Erigeron lonchophyllus</i>	<i>Arnica rhizomata</i>
<i>Antennaria rosea</i>	<i>Senecio cymbalariaeoides</i>
D. <i>Antennaria nitida</i>	var. <i>borealis</i>
<i>Antennaria campestris</i>	<i>Senecio pauperulus</i>
<i>Helianthus rigidus</i>	<i>Cirsium Drummondii</i>
<i>Achillea Millefolium</i>	<i>Lactuca pulchella</i>
D. <i>Artemisia canadensis</i>	<i>Taraxacum dumetorum</i>

In 167 species in this list, it is of interest that only 20 (about 12%) are not found in the prairies of the Wood Buffalo Park. Since woodland species show a falling off of about 20% in the same range, by averaging we may say that the combined woodland and prairie floras in the Wood Buffalo Park portion of the Peace River drainage are about 84%, in number of species, of those on the higher plains of the Peace. The greater importance of the Hudson Hope district as a transition area is indicated by the fact that only about 60% of the woodland species in the cordilleran section are represented farther eastward. The comparatively uniform marsh and muskeg floras are not considered in these figures. Many of the species not found in the Wood Buffalo Park have been collected far down the Peace (Carcajou district), indicating a probably floristic continuity reaching from the mountains to the neighborhood of Vermilion, and beyond this point at higher levels. *Aster conspicuus*, *Carex loliacea*, and *Pinus contorta* var. *latifolia*, found on the Caribou Mountains, suggest the latter projection.

The grasslands vary in their predominating species apparently according to the supply of available water, and although there is a great variety of intergrading conditions, a rough division may be made between semi-moist and very dry. In the above list those species which are more or less confined to the latter are designated "D.". The dry prairies have their greatest development on the southward-facing slopes of the river bluffs or on their adjoining wind-swept tops. The exposure of these places undoubtedly plays an important part in the dessication, but their more complete drainage is also significant. In fact, sandy well-

drained soils in the prairies of the hinterland develop the same flora even in the protected beds of dry streams (85). The dominant plants of the dry prairies are *Agropyron trachycaulum* var. *typicum* and var. *unilaterale*, *Stipa comata*, *Carex siccata*, *Carex obtusata*, and *Koeleria cristata*. The *Stipa* and the carices are characteristic of the more xerophytic situations while the others make a thick turf on the plains farther back from the dry bluffs. The most completely xerophytic conditions are to be found on the steepest southward-facing bluffs of the larger streams. Here there is an open association of *Artemisia frigida*, *Elaeagnus argentea*, *Amelanchier florida*, *Prunus demissa*, *Apocynum androsaemifolium*, *Juniperus* spp., and in places *Opuntia polyacantha*, with a scattering of the more drought-resisting of the other prairie species.

Away from the rivers, on plains of gentle slope or in very slightly ponded conditions, *Poa pratensis*, *Calamagrostis canadensis* var. *robusta*, and *Carex trichocarpa* var. *aristata* are predominant, the last being characteristic of the wetter habitats. As noted above, local conditions of more complete drainage or exposure produce a recurrence of the river bluff flora.

The principal variation in the prairie flora is caused by local saline waters. These are of rather common occurrence, but the largest area so affected is the "Salt Plain" west of the upper Slave River. Out-wash from salt springs in this neighborhood, and the comparatively level and partially ponded terraine have combined to produce shallow evaporation basins around which a halophytic vegetation occurs. It is very similar in flora to salt flats on the northern Great Plains.

The aspen woods which border the prairies in the Hudson Hope district may be characterized as follows:

#### PRIMARY SPP.:

<i>Populus tremuloides</i>	<i>Amelanchier florida</i>
<i>Salix Bebbiana</i>	<i>Symphoricarpos albus</i>
<i>Rosa acicularis</i>	var. <i>pauciflorus</i>

#### SECONDARY SPP.:

<i>Agropyron trachycaulum</i>	<i>Smilacina stellata</i>
var. <i>unilaterale</i>	<i>Delphinium scopulorum</i>
<i>Schizachne purpurascens</i>	var. <i>glaucum</i>
<i>Oryzopsis asperifolia</i>	<i>Thalictrum venulosum</i>

<i>Fragaria glauca</i>	<i>Mertensia paniculata</i>
<i>Lathyrus ochroleucus</i>	<i>Galium boreale</i>
<i>Vicia americana</i>	<i>Aster Lindleyanus</i>
<i>Zizia cordata</i>	<i>Achillea Millefolium</i>
<i>Heracleum lanatum</i>	

The addition of a few common species to this list, which represents only one spot, would make it suitable for the aspen woods of most of the region: *Viburnum pauciflorum*, *Lonicera glaucescens*, *Elymus innovatus*, *Botrychium Lunaria*, *Habenaria viridis* var., *Aster junceus*. The trees are usually in a rather open stand but the undergrowth is relatively dense for forests in this region, only being surpassed in thickness by the brush in recently burnt-over woods. The above lists show that the ground flora is prevailingly that of the prairie, the trees and shrubs, as it were, having been superposed upon it.

#### ORIGIN AND DEVELOPMENT OF THE SEMI-OPEN PRAIRIES

The belt of coniferous forest which stretches across the northern part of the continent, bounded on the north by the arctic tundra and on the south by the deciduous forests or treeless plains, is generally regarded as a climatic formation. That is, general conditions of temperature, rainfall, and evaporation throughout the year are suitable for the growth of trees. We have to deal therefore with the somewhat anomalous situation of true grasslands appearing not only as parts of the transition between the forests and the interior grassy plains, but also scattered through the whole width of the forest belt in the central and southern parts of the Mackenzie basin.

Certain essential facts, some of which have already been mentioned, are: first, so far as they are known at present (chiefly in the agricultural districts and the Wood Buffalo Park), the semi-open prairies are confined to loamy soils of post-Glacial lacustrine origin; second, they occur on land surfaces which have a fairly efficient surface drainage; third, the grasslands seem to represent a virgin type of vegetation on the soils which they occupy, using the term "type" in a broad sense; fourth, aspen and occasionally spruce forests are slowly encroaching upon the prairies although in many places but little progress has been made; fifth, grassland soils on the uppermost of the post-Glacial lake bottoms show the greatest development of concentration layers for lime and nitrates.

The prairie lands of the upper Peace occupy the long gentle slopes between the erosion plateaus and the immediate valleys of the streams (87). The good drainage is shown, among other ways, by the scarcity of lakes and ponds on their surfaces. The same kind of slope was found at the eastern base of the Caribou Mountains where the fall is approximately 50—100 feet in 5 miles. Marshes and swamps are occasional, either in very shallow sag depressions or in areas whose drainage lines have been dammed by morainic materials.

Soil sections made near Hudson Hope, at the base of the Caribou Mountains, and at Peace Point all fail to show remnants, except on a small scale in the last-named place, of any previous forest or moorland types of vegetation at or near the surface. In some of the sections carbonized remains were found at considerable depth, and are evidently referable to some earlier stage in the deposit of the soils, perhaps to an interval during the formation of the lake expansions. There remains but one type of vegetation as a cover for these soils since the time of their exposure. This must have been either a comparatively xerophytic grassland or some other association of herbaceous or thalloid plants of small stature such as grow in tundra. Sections in marginal aspen woods show dark soils which differ but little in texture from those of the prairie. In the Hudson Hope region, however, where there is a lime concentration layer about a foot below the surface of the prairie, the marginal aspen soils fail to show this layer. The woods give the impression of being very young. There is no mossy cover, and prairie herbs are found throughout. The section shows almost no accumulation of humus materials at the surface. Wherever the marginal poplar woods abutts upon a morainic ridge or other sharp topographic demarcation involving another soil, the transition to the sand ridge or other vegetation is a sharp one, and it is in such places that the small progress made by the aspens in their advance upon the prairie is evident, for they usually show but a narrow band between the open grassland and the neighboring slope.

The following (Fig. 7) are prairie soil sections made in the summer of 1932.<sup>1</sup>

<sup>1</sup>Determinations of nitrogen content were made by the method involving diphenylamine and sulfuric acid, and with field apparatus designed by Dr. H. E. Pulling of Wellesley College. The writer is indebted to Dr. Pulling also for helpful criticism in the interpretation of soil data. Imperfections in this method of determining soil nitrogen are well-known, but in the present problem it has been of service by helping to define the different horizons.

Two facts brought out by comparison of these sections are of especial interest. First, as noted above, the concentration of limy and nitrogenous materials is much less marked at Peace Point than at Hudson Hope. The layers are thin, occupy much less space, and show very little nitrogen. Second, in the upper part of the Peace Point section the rather thin dark bands indicate that at intervals during the last stages of the lake there must

Prairie near Hudson Hope		Prairie at Peace Point
3"	Grass turf with brownish-black humus. N=0	3" { Upper third a thin grass turf with humus; lower part a grayish sandy loam with grass roots.
4"	Brown loam in small particles, up to $\frac{1}{16}$ in. dia. Few roots. N=10-15	13" { Grayish to reddish sandy loam with horizontal dark bands lightening in color with depth, and a narrow streak of carbonized materials about 3 in. above the bottom. Slightly crumby in structure. Many rootlets. N=0
12"	Brown clay loam similar to the above, but with less crumming. Streaked horizontally with brownish-gray clayey lenses up to $\frac{1}{2}$ in. thick and 1 ft. wide, these laminated with thin darker layers.  In lenses N=15+	4" { Light reddish sandy loam with a few rounded pebbles up to $1\frac{1}{2}$ in. dia. Few rootlets. N=2-
12"	Brown loam with carbonized materials in thin strata.	15" { Reddish sandy loam, light red at top and shading to gray at bottom. Few rootlets. N=2
		27" { Grayish loam with light gray, more or less horizontal lens-like streaks, highest at top and disappearing at bottom. Much clayey material. Few rootlets, mostly dead. N=2

FIGURE 7. PRAIRIE SOIL SECTIONS AT HUDSON HOPE AND PEACE POINT.

have been conditions suitable for the accumulation of small amounts of peaty materials. If these occurred in the later stages of the Hudson Hope lake expansion there is no evidence of them at present. A section made in 1930 near the base of the Caribou Mountains bears a close resemblance to that at Peace Point, but lacks the thin blackened layers near the surface.

With these facts in mind we may draw up a fair approximation of conditions on the glacio-lacustrine soils at the withdrawal of the lakes in which they were deposited. Due to good drainage they must have presented a comparatively dry surface, and the subsoil must have remained permanently frozen throughout the year as it does today in the more northern regions. For some reason they did not develop peaty accumulations of any depth on their retreating shore lines. Two causes may be suggested to account for this. First, the climate may have been much more arctic than it is at present, permitting only a tundra vegetation with no opportunity for the development of low moors or mossy peats on the receding and well-drained shores. Second, the drainage of the lakes may have been so rapid that the shore lines were not permanent enough for the development of deep marshes. So far as is known the lakes were impounded by nothing more stable than ice dams or local morainic deposits of unconsolidated materials, so that once the drainage streams, perhaps flowing southeastward by way of the Clearwater and Stone River regions, and later via the Mackenzie (10), began to lower their beds, the process would go on with comparative rapidity.

It is notable that the last of the post-Glacial lakes in the lower Peace region (about 700 feet above sea-level) stood at nearly the same level as the modern lake Athabaska. The drainage channel of this lake must very early have encountered the granite outlier in the Fort Smith district which remains the principal barrier to any further lowering of its level. Consequently it has maintained a fairly stable shore line and a vast settling basin for the detritus brought in by the Peace and Athabaska Rivers. The relative stability of its level has promoted the growth of marsh lands of wide extent with accompanying thick deposits of plant remains, a condition quite different from that on the earlier lake bottoms. The presence of plant remains near the surface of the Peace Point soils may indicate a slower drainage of the 800-foot lake than took place even of the next higher one (1100-ft.). On the theory of a climatic control, on the other hand, the later lakes may have been drained when the tundra condition was beginning to disappear, thus making possible a richer growth of marsh plants. Still another cause for a certain amount of peat accumulation on the 800-foot level might be that the lowest lakes were smaller and shallower than the upper ones so that upon drainage

their surfaces would remain for a time more ponded, giving opportunity for the development of marshes. Partially ponded areas on the Salt Plain tend to support this idea and may very well be a continuation into modern times of the same set of factors which produced the surface soils at Peace Point.

Whether subarctic forests covered the lighter soils of the region during the early history of the semi-open prairies is uncertain. The oldest lands available were the tops of the erosion plateaus, and it is possible that they acquired their timber very early. At least they seem to have progressed farther in the development of rich woodlands, with their outliers of the cordilleran forests. But the writer has already emphasized the apparent youth of the white spruce woods in the Athabaska-Great Slave Lake region (83), and the preceding discussion of the forests of the Peace River country indicates that at lower levels these also betray an immature condition. It has also been suggested (82) that one of the main components of the forest of the lower Peace, *Pinus Banksiana*, is a rather recent arrival in the region. If these contentions are correct, then the non-muskeg forest is not far removed from the condition in which we find it near its northeastern margin — composed almost entirely of white spruce in a park-like stand and with a light undergrowth and ground cover. It is possible or even probable therefore that at the inception of vegetation on at least the higher lacustrine soils, there was very little tree growth in the whole region.

It has been shown that in parts of Alaska the coniferous forest occurs in close proximity to modern glaciers (17), but it is somewhat doubtful if this could have occurred on the drier interior plains of the continent. If the forest could advance so vigorously here we should expect it to extend much farther northeastward than it does, but it appears to have been halted at its present limit by effective climatic barriers, and in a complex of conditions quite different from those of southeastern Alaska.

The permanently frozen subsoil, the compactness and relatively poor aeration of the clays, and the probable early start of prairie sod would all tend to delay the encroachment of timber. Another factor of importance is the short growing season with its accompanying cold winters, greatly retarding the ordinary processes of decay and humus formation so necessary to the development of forests. Whatever the causes it is evident that in many places,

especially upon the lower levels, timber has made but little progress in its invasion of the prairies.

It seems clear therefore that the grasslands of the Mackenzie basin developed directly from some closely similar type of plant cover which may have been an arctic grassy or sedgy tundra, and that no forests have encroached upon them extensively. It is further evident that no peat-forming vegetations have ever modified them to any extent with the possible exception of some areas on the youngest land surfaces.

Fire has always been one of man's most important tools in the clearing of land for his agricultural pursuits; consequently it has required but a short step in his reasoning to credit the prairie openings in virgin country to this agency. Indians are usually made responsible. The earliest explanations of the Peace River prairies, as well as some later ones [McConnell (52), Drummond (25), Whitford and Craig (101)] are of this sort. The absence of remnants of burned timber stands, or of any woodland vegetations whatever on the grasslands seems to relegate fire to its proper place among environmental influences. Moss's treatment of it merely as a check upon the advance of the aspen woods seems most reasonable at present (74). His observations as well as our own show that burned poplar stands return to poplar, by shorter or longer processes depending upon the nature of the fire.

If some distinctive climatic region or subregion covering the Mackenzie basin grasslands could be outlined, an explanation of their occurrence could perhaps be simplified. But from available data collected at stations scattered all the way from Grande Prairie to Great Slave Lake no such correlation seems to arise. In the discussion of climate we have seen that the Peace River country from the mountains to Vermilion is essentially uniform so far as present data are concerned, but that north of that region the summer precipitation falls off and the growing season becomes increasingly hazardous. The grasslands, however, are prominently developed in the Wood Buffalo Park and farther north, with apparent disregard for these changes. An inspection of the climatic maps of Canada (48) shows most of the Mackenzie basin grasslands occurring in the region of 10—15-inch mean annual precipitation, which also includes most of the forested regions of Mackenzie, northern Saskatchewan, and northern Manitoba.

More significant than this, a map showing the percentage of mean annual precipitation occurring during the months of May to August, inclusive, shows the Peace River valley proper in the same province with most of northern Saskatchewan and Manitoba, and a considerable portion of southern Manitoba. The climatic data indicate that there is a somewhat greater rainfall and a shorter growing season in the lower Athabasca basin than on the Peace, a condition which might be related to the lesser development of the prairies in that direction. But the occurrence of what appear to be natural prairies on a local deposit of loamy soil at McMurray suggests that a greater development of these soils there would lead to a wider extent of prairie land. Similarly, temperature records fail to show any distinctive characteristics for the region in question. The agricultural district of the upper Peace is said to be subject to less extremes of temperature than any other part of Alberta, this probably due to the lower elevation of the mountains. The chinook winds of winter are well known there, and it is suggested that they may have helped to retard the development of parkland timber in the larger grassland areas near the mountains. These conditions, however, become steadily less marked to the northeast, although there is no break in the semi-open prairies. Data at hand, therefore, fail to yield sufficient climatic causes alone for the presence of grasslands so much scattered through the northern forest. If the problem is viewed from still another angle the entire Canadian forest belt of the central Mackenzie basin might be looked upon as a vast "parkland" transition between forest and prairie (or tundra); but as pointed out above, it is difficult to reconcile this concept with the known climatic data since most of the region appears to have as suitable a climate for the development of forest as northern Saskatchewan and Manitoba.

Many years ago John Macoun noted the similarity between the Peace River prairies and those of the "Second Prairie Steppe" of the northern Great Plains (15). Subsequent study has verified this opinion, for there is not only a similarity in general appearance but also in the dominating elements of the flora. Associations of *Agropyron trachycaulum* vars., *Koeleria cristata*, and *Stipa comata* are common to both. It would be interesting therefore to see whether the comparison could be carried further with the same result.

The most important investigations of the Canadian parklands have been made by R. D. Bird in southern Manitoba (3), and by E. H. Moss (74) in central Alberta.<sup>1</sup> Bird seems to consider the prairie only as a northern extension of the Great Plains, "The prairie of the aspen parkland is an association of the tall grass of the eastern Great Plains, as described by Shantz ('23), and extends by finger-like projections and isolated areas throughout the parkland." In his discussion of topographic relationships he has the following significant observations: "Throughout the territory now occupied by the aspen parkland the surface material consists of these Pleistocene deposits, and it is with them and their variations that we are now concerned." . . . "In the areas occupied by the glacial lakes Agassiz and Souris this material was sorted out and deposited as fine silts and clays in the deeper parts of the lakes. Near the shore, and where rivers entered, deltas of coarser material were formed. The largest and most influential (ecologically) of these deltas was formed where the Assiniboine river entered Lake Agassiz. . . . It is on these dunes . . . that we find an isolated area of white spruce." . . . "The bottom lands of Lake Souris are high and dry, and have been covered for years by prairie which is even now only slowly giving way to the advancing aspen forest. On the other hand, the country which was covered by Lake Agassiz is low and marshy. . . . The highlands of the province, not being subject to the inundations of the lowlands, have been forested for a long time." In general, the parkland is considered by Bird to be an ecotone between prairie and woodland.

That the aspen forest is a climax type is, as Bird admits, open to question, but in the light of studies in the Peace River region it seems that the presence of prairies must be interpreted in some

<sup>1</sup>Bird considers the aspen as a climax association in his region, and "that the spruce is restricted to soils of a rocky or sandy nature such as are present over the great area covered by the northern formation, and is found south of this region only where soils approach this condition. . . . It certainly looks as if the coniferous forest were isolated in relict areas by edaphic conditions which enable it to survive in otherwise unfavorable surroundings." And, "On the north the aspen is in some places being replaced by white spruce. . . . This replacement is slow, and, in the opinion of the writer, is largely controlled by edaphic conditions, for the spruce seems to be very partial to rocky and sandy soils. It is found to the south in soils of this nature, e.g. the sand hills near Carberry, Manitoba, indicating that spruce was scattered over the whole area and that the trees have died or that they never gained a foothold in the intervening land. These isolated areas may be explained by spruce having followed close behind the ice as it receded at the end of the glacial period and remaining wherever conditions are favorable."

other way than by regarding them purely as extensions of the "climatic" grasslands of the interior. Although he does not enlarge upon them, his notes on topographic distribution suggest conditions similar to those in the Mackenzie basin — the forested uplands (Riding Mountains, Turtle Mountain, etc., all erosion plateaus or morainic deposits), the semi-open country on the well-drained higher lake bottoms, and the marshes in the Lake Agassiz lowlands.

Moss expresses the view that prairie is the primitive vegetation in much of the poplar and parkland country of central Alberta (74): "There is good reason to believe that the greater part of the black soil area was originally dominated by grasses and that the poplar vegetation has come in rather recently in soil history . . ." and ". . . the soils of most of the Parkland and Poplar Areas are of the grassland rather than the wooded type. Furthermore, with the exception of the black soils in the extreme northern and western parts of the Poplar Area, the soils show only a slight transformation of the kind expected in grassland soils that have been wooded for many centuries." It is his opinion that the aspen is invading the prairie and is being checked in its advance chiefly by burning. Other checks are snow-shoe rabbits, clearing and grazing in settled areas, and in the early days great herds of bison. His evidence of the effects of burning is at once ingenious and convincing, but whether these agencies have actually enlarged the prairie is still doubtful. We have observed no indication of it in the Mackenzie basin.<sup>1</sup> He is inclined to agree with Bird that the aspen is climax in the parkland and in the southern part of the poplar area, and that the spruce, even in the absence of burning, would not invade it.

From the above notes there seems to be one essential difference between the semi-open country of the Saskatchewan and Mackenzie basins. In the former the aspen woods are not much if at all affected by the invasion of spruce, at least in modern times, and the aspen may represent a climax type in itself, whereas in

<sup>1</sup>Moss has this to say of the phytogeographic significance of the poplar belt, ". . . the poplar area has usually been looked upon as a broad transition belt between climatic formations, but it may be regarded in other ways, viz. (1) as itself a climatic, or possibly, an edaphic, formation; (2) as an extension of the Northern and Cordilleran Forests, probably, in the main, of the Northern Forest. At present we are inclined to the latter view. . . ." Whether this division of poplar and parkland vegetations is applicable to the Mackenzie basin is uncertain.

the Peace River region the spruce may be at the prairie margin to the entire exclusion of the aspens.

The distribution of much of the eastern parkland, and possibly also the western, upon glacio-lacustrine soils among which there seems to be a definite succession in age, suggests that the grasslands may be largely of edaphic control as they appear to be in the Mackenzie basin.<sup>1</sup> Likewise, they could be considered as direct descendants from some form of tundra which started on soils left exposed when the Keewatin glacier and its impounded lakes disappeared from the lower Saskatchewan. It is of interest in this connection that at least in Saskatchewan and Manitoba the parklands are outlined roughly by the topographic boundaries of the Second Prairie Steppe (3, 18, 78). How such a classification would apply in central Alberta is uncertain, but the Mackenzie basin prairie lands probably constitute a physiographic counterpart of the second steppe of the eastern prairie provinces.<sup>2</sup>

On the basis of floristic (29) and peat bog studies (90), the prairie "relics" in the southern Great Lakes states have been accounted for by climatic changes in post-Pleistocene time. Warm or cool dry climates of more continental nature with intervening humid periods are thought to have brought on greater developments of grasslands than now occur, and that relic prairie areas, for instance, in Ohio, are remnants of the last of these dry eras. In Ohio a dry cool period in which pine pollen is predominant in bog deposits was followed by a humid moderate one in which beach and mixed deciduous forests held the stage. Following this, oak and hickory dominated in a warm dry period, and then came a warm humid one of mixed deciduous forest.<sup>3</sup>

We have no pollen analyses of peat deposits in the Mackenzie basin, but it seems that if the prairie lands were ever covered with forests we should find remains of them near the surface of

<sup>1</sup>A recent paper by W. A. Johnston and R. T. D. Wickenden on a glacial lake bed in the Regina district of Saskatchewan (*Trans. Roy. Soc. Canada, Sect. iv. 41—9, 1930*) is significant in this problem.

<sup>2</sup>It is of further interest that Joel and others, from soil studies in Saskatchewan, conclude that there is a "marked influence of parent materials on the character of soil profiles, particularly in the grassland and park zones" (42).

<sup>3</sup>There is no occasion in the present paper for reviewing the large and varied literature on the origin and development of prairies in the middle west. Several of the more recent papers such as those of Shimek (92, 93, 94) and Gleason (29) should be consulted not only for treatments of the problem itself but also for bibliography.

the prairie soils. The absence of such materials, especially in a region of such slow decay, indicates that if any climatic changes took place they did not seriously affect the grassland (or tundra) as a type of vegetation. The facies of the prairie flora might have been altered, and the rate of invasion of the marginal timber may have been retarded or increased, but the country must have remained generally open. The present range of a single prairie facies from the plains of central Manitoba, Saskatchewan, and Alberta northward through the forests nearly to lat.  $60^{\circ}$ , and the presence of some form of prairie nearly all the way through to the arctic tundra, indicates that as a type of vegetation it need not here be subject to climatic control. Nor should it always be regarded as an indicator of any special type of climate. As noted in the descriptions of the prairie associations, the more xerophytic type may be found on the river bluffs where exposure is probably the most important factor in its persistence, but its occurrence inland on especially dry soils, regardless of local climatic factors, shows its potential independence of these factors.

As indicated above, we have no evidence of anything other than a gradual amelioration of the Mackenzie basin climate in post-Glacial time. Investigation of peats may yield something of the kind, but there is no evidence of it in the semi-open prairie country up to the present time. J. B. Tyrrell, one of the foremost students of the Pleistocene of northern Canada, was as well a keen observer of the vegetation in its relation to climate and topography. In a paper on post-Glacial climatic change in northwestern Canada (98) we find the following significant remarks:

"As the glacier retired northward across what are now the great plains between the southern boundary of Canada and the forest region which stretches northwestward through Manitoba and Saskatchewan and then westward across Alberta, the climate was probably at first much like that of the Barren Lands at the present time with a mean summer temperature below  $10^{\circ}$  C., permanently frozen subsoil, and consequently a complete absence of trees. As the glacier retired farther northward and the climate of these southern plains became warmer, it also became drier, so that no forests were able to grow on them, neither were *Sphagnum* swamps ever formed on them. The whole known climatic history of these grassy plains is therefore included in the statement that a cold climate was succeeded by a dry continental

climate, under neither of which conditions was forest growth possible." Concerning the northern forest: "It is not an uncommon occurrence to find many of the trees in the most remote northern groves dead, but again most of them are alive, and as far as I could determine they furnish no evidence of a change in climatic conditions in recent times.

"As far as my observation goes, *Sphagnum* bogs are only found in the forest region. . . . They are very extensively developed in the wooded lowlands of northern Manitoba, overlying the lacustrine clays of Lake Agassiz, and they extend northward to the northern limits of the forest where they are often associated with chrysophenes or buried sheets of ice found in springs."

In describing the "Barren Lands": "Evidence of the former existence of trees on this country might have been largely destroyed, but if *Sphagnum* bogs had ever been formed on it, they would be there at the present time. The absence of such bogs, and of any traces of the former existence of forest, would clearly indicate that the Barren Lands have not experienced any warmer climate since the end of the Glacial period than they are getting at the present time.

"Thus the results of all the observations made up to the present time throughout northwestern Canada point to the conclusion that there has been a fairly continuous amelioration of the climate since the retirement of the Keewatin and Labradorian glaciers."

Whether or not we concur in the climatic interpretation of all of the northern grasslands, Tyrrell's note on the continuity of a treeless and bogless type of vegetation on the northern plains ever since their inception is especially significant in the light of recent findings in the Mackenzie basin.

Balancing the evidence on the relative importance of climatic and edaphic factors, the latter appear by far the most significant in the determination of the present distribution of the prairies in the Mackenzie basin. The limitation of the grasslands to soils of a particular kind and the distribution of dry and damp prairies in part at least independently of local climatic factors support this contention. More precise knowledge of the climatic factors and their interrelationships may throw new light on the question, but for the present the youth and nature of the land surfaces with their immaturely developed soils seem to offer the best correlation with the known distribution of the vegetation.

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CATALOGUE OF THE  
VASCULAR PLANTS OF THE PEACE AND  
UPPER LIARD RIVER REGIONS

OPHIOGLOSSACEAE

**Botrychium Lunaria** (L.) Sw.

Dry thickets. High river bluff, Hudson Hope, June 21, no. 3644; near timber line, Mt. Selwyn, July 23, no. 4041. — McLeod L., *John Macoun*, nos. 28540, 80355 (O); upper Halfway R., alt. 4000 ft., *Mrs. Henry*, no. 246 (P).

**Botrychium boreale** Milde.

South fork of Nelson R., alt. 4500 ft., *Mrs. Henry*, no. 160 (P).

**Botrychium virginianum** (L.) Sw. var. **europaeum** Angström. — See Rhod. xvii. 233—4 (1915); xix. 207—16 (1917).

Upland poplar-spruce woods S. of Peace R. at Hudson Hope, June 21, no. 3635. Sporangia immature.

POLYPODIACEAE

**Woodsia glabella** R. Br.

Shallow cave, Chandlee R., alt. 2800 ft., *Mrs. Henry*, no. 100 (P.)

**Woodsia oregana** D. C. Eat.

McLeod L., *John Macoun* (O).

**Woodsia scopulina** D. C. Eat.

Crevices in quartz cliff, N. W. slope of Mt. Selwyn, alt. about 3000 ft., no. 3895. In fruit.

**Cystopteris fragilis** (L.) Bernh. — *Filix fragilis* (L.) Gilib.

Damp rock crevices or rich woods. Mt. Selwyn, alt. 4—5000 ft., July 19, 26, nos. 3936, 4109, 4182; limestone rock slide N. of the Peace R., opposite Mt. Selwyn, July 22, no. 4008; woods near upper end of Rocky Mt. Canyon, July 7, nos. 3746a; limestone rocks on river bank, Hudson Hope, June 22, no. 3656. All in fruit. — Mountains near St. Paul's L., alt. 6700 ft., *Mrs. Henry*, no. 125 (P); cave near Chandlee R., alt. 2800 ft., *Mrs. Henry*, no. 101 (P).

**Cystopteris montana** (Lam.) Bernh. — *Filix montana* (Lam.) Underw.

Lesser Slave L. district, *Brinkman*, no. 4211 (C).

**Pteretis nodulosa** (Michx.) Nieuwl. — *Onoclea Struthiopteris* Amer. auth., not Hoffm. — *Matteuccia Struthiopteris* Amer. auth., not Todaro. — See Rhod. xvii. 164 (1915).

Thicket in abandoned-channel slough along Peace R., near mouth of Wicked R., July 22, no. 4007. With both young and old fertile fronds. — Near Lesser Slave L., Moss, no. 2398 (G).

**Thelypteris Dryopteris** (L.) Slosson. — *Phegopteris Dryopteris* (L.) Fée.

Rich woods along Peace R., near mouth of Quartz Cr. at base of Mt. Selwyn, July 21, no. 3996. In fruit. — Lesser Slave L. district, Brinkman, no. 3991 (C).

**Thelypteris Robertiana** (Hoffm.) Slosson. — *Phegopteris Robertiana* (Hoffm.) A. Br.

In shallow cave near Chandlee R., Mrs. Henry, 97 (P).

**Thelypteris fragrans** (L.) Nieuwl. — *Dryopteris fragrans* (L.) Schott. — *Aspidium fragrans* (L.) Sw.

Damp crevices in quartz cliff, N. W. slope of Mt. Selwyn, alt. about 3000 ft., July 19, no. 3894. In fruit. — Frances R., Yukon, Dawson, no. 28704 (O).

**Thelypteris spinulosa** (O. F. Müll.) Nieuwl. — *Dryopteris spinulosa* (O. F. Müll.) Ktze. — *Aspidium spinulosum* (O. F. Müll.) Sw.

Lesser Slave L. district, Brinkman, no. 4173 (C), and Moss, no. 2236 (G).

**Thelypteris spinulosa** (O. F. Müll.) Nieuwl. var. **dilatata** (Hoffm.) St. John. — *Dryopteris dilatata* (Hoffm.) Underw. — *Aspidium spinulosum* var. *dilatum* (Hoffm.) Hook.

Quartz ledge in upper part of timber, N. W. slope of Mt. Selwyn, July 19, no. 3912; rich woods along Peace R. at Quartz Cr., July 29, no. 4213. In fruit. This material is referred here tentatively, and bears a close relationship to var. *americana* (Fisch.) Weatherby.

**Polystichum Lonchitis** (L.) Roth.

Head of Sukunka R., Sheldon and Borden.

**ASPLENIUM TRICHOMANES** L.

Mountains along Peace R., John Macoun, 1875.

**ASPLENIUM VIRIDE** Huds.

Mountains along Peace R., John Macoun, 1875.

**Athyrium Filix-femina** (L.) Roth. — *Asplenium Filix-femina* (L.) Bernh. — See Rhod. xix. 179—81, 197—201 (1917).

Rich woods. Along Peace R. near mouth of Wicked R., July 22, no. 4006; near upper end of Rocky Mt. Canyon, July 7, no. 3746. Both nos. in fruit, the first with very young sori. — Lesser Slave L. district, *Brinkman*, no. 4330 (C), and *Moss*, no. 2397 (G).

**PELLAEA ATROPURPUREA** (L.) Link. — probably *P. GLABELLA* Mett. apud Kuhn. — See Amer. Fern Jour. vii. 3, 84 (1917); xi. 40 (1921).

Mountains along Peace R., *John Macoun*, 1875.

**Cryptogramma Stelleri** (Gmel.) Prantl.

Shallow cave near Chandlee R., (fertile), and in rock crevices near sulfur springs (sterile), about lat. 58°, alt. 2800 ft., *Mrs. Henry*, nos. 98, 99 (P).

**Polypodium virginianum** L. — See Rhod. xxiv. 125 (1922).

Crevices in quartz ledge, N. W. slope of Mt. Selwyn, alt. about 3000 ft., July 19, no 3893. In fruit.

EQUISETACEAE

**Equisetum arvense** L.

Moist ravine in river bluff S. of Peace R. at Hudson Hope, June 21, no 3643; muskeg along Carbon R., Aug. 2, no. 4288. The Hudson Hope specimens with both fruiting and sterile stems, the others sterile. — Lesser Slave L. district, *Brinkman*, no. 3976 (N); edge of Halfway R., alt. 2000 ft., *Mrs. Henry*, no. 215 (P).

**Equisetum pratense** Ehrh.

Rich woods along Peace R. near mouth of Quartz Cr., July 29, no. 4202; willow thicket near Dawson Creek, June 8, no. 3516. Sterile stems in both nos. — Lesser Slave L. district, *Brinkman*, no. 4119 (N); Racing R., alt. 4500 ft., *Mrs. Henry*, no. 123 (P).

**Equisetum sylvaticum** L. var. **pauciramosum** Milde. — See Rhod. xx. 129 (1918).

Wet meadow near W. end of Rocky Mt. Portage, Aug. 3, no. 4319. With sterile stems only. — Lesser Slave L. district, *Brinkman*, no. 4118 (N).

**Equisetum palustre** L.

Muddy shores. Peace R. at mouth of Quartz Cr., July 29, no. 4201; Carbon R., about 4 mi. above the Peace, Aug. 2, no. 4265. Both nos. with sterile stems only. — Lesser Slave L. district, *John Macoun*, no. 28826 (O), and *Brinkman*, no. 4608 (N).

**Equisetum limosum** L. — *E. fluviatile* L. — See Rhod. xxiii. 43 (1921).

Slough along Peace R., opposite Mt. Selwyn, July 22, no. 4037. Sterile stems only. — McLeod L., *John Macoun*, no. 28821 (O); Lesser Slave L. district, *Brinkman*, nos. 4055, 4317 (N).

**Equisetum hyemale** L.

Springy slope of river bank at Hudson Hope, June 22, no. 3660. In fruit.

**Equisetum prealtum** Raf. — *E. robustum* A. Br. — *E. hyemale* var. *robustum* (A. Br.) A. A. Eat. — *E. hyemale* var. *affine* (Engelm.) A. A. Eat.

Sandy ridges at Hudson Hope, June 20, no. 3631. In fruit. — Lesser Slave L. district, *Brinkman*, no. 4061 (N).

**Equisetum scirpoides** Michx.

Rich woods. Along Wicked R., July 14, no. 3831; near upper end of Rocky Mt. Portage, July 7, no. 3748; ravine in high bluff at Hudson Hope, June 16, no. 3613. The Portage specimen is in fruit, the others sterile.

**Equisetum variegatum** Schleich.

Damp shore of small lake, W. slope of Mt. Selwyn, alt. about 5000 ft., June 26, no. 4133; muddy banks of Peace R., near the Wicked R., July 16, no. 3859, and at the head of the Rocky Mt. Canyon, July 7, no. 3738; rich woods along Wicked R., July 14, no. 3817; muskeg along Carbon R., Aug. 2, no. 4277. The last two nos. sterile, the others with fruiting cones. — Upper Liard R., *Dawson*, no. 28768 (O).

### LYCOPODIACEAE

**Lycopodium Selago** L.

Damp mossy ledges, W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4086. Found with both sporangia and bulbils.

**Lycopodium lucidulum** Michx.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Lycopodium annotinum** L.

Rich woods at base of Mt. Selwyn near mouth of Quartz Cr., July 21, no. 3991. In fruit. — Near Chandlee R., *Mrs. Henry*, no. 103 (P); spruce forest near Graham R., alt. 4500 ft., *Mrs. Henry*, no. 156 (P).

**Lycopodium annotinum** L. var *pungens* Desv.

Lesser Slave L. district, *Brinkman*, no. 4014 (N).

**Lycopodium annotinum** L. var. **acrifolium** Fern. — See Rhod. xvii. 123 (1915).

Lesser Slave L. district, *Brinkman*, no. 3989 (N).

**Lycopodium clavatum** L. var. **monostachyon** Grev. & Hook. — See Rhod. xii. 50—5 (1910) for this and the next.

Quartz ledge on N. W. slope of Mt. Selwyn, alt. about 3500 ft., July 26, no. 4165. In fruit.

**Lycopodium clavatum** L. var. **megastachyon** Fern. & Bissell.

Lesser Slave L. district, *Brinkman*, nos. 3932, 4069 (N).

**Lycopodium obscurum** L. var. **dendroideum** (Michx.) D. C. Eat. — See Rhod. xxiii. 188 (1921).

Rich woods at base of Mt. Selwyn near mouth of Quartz Cr., July 21, no. 3993. In fruit. — Lesser Slave L. district, *Brinkman*, no. 3931 (N).

**Lycopodium sabinaefolium** Willd. var. **sitchensis** (Rupr.) Fern. — *L. sitchensis* Rupr. — See Rhod. xxv. 166 (1923).

Lesser Slave L. district, *Brinkman*, nos. 4013 (N), 4068 (C).

**Lycopodium alpinum** L.

Grassy slope on Mt. Selwyn, alt. about 4500 ft., July 26, no. 4142. In fruit. — *Mrs. Henry*, 1932 (no data) (P).

**Lycopodium complanatum** L.

Rich woods at base of Mt. Selwyn near mouth of Quartz Cr., July 21, no. 3990. In fruit. — Lesser Slave L. district, *Brinkman*, nos. 3974, 4019 (N).

#### SELAGINELLACEAE

**Selaginella selaginoides** (L.) Link.

Damp mossy bank of Wicked R. near the Peace, July 16, no. 3845. In fruit.

**Selaginella Standleyi** Maxon. — See Smithson. Misc. Coll. 72, no. 5, p. 9 (1920), and Amer. Fern Jour. xi. 36—9 (1921).

Stony ground on summit of Mt. Selwyn, July 19, no. 3910. In fruit.

#### PINACEAE

**Picea glauca** Voss. — *P. canadensis* B. S. P., not Link. — *P. alba* Link. — See Rhod. xvii. 59—62 (1915).

Quartz ledge on N. W. slope of Mt. Selwyn, July 23, no. 4195 (stunted tree about 15 ft. high); along Peace R. near mouth of

Quartz Cr., July 29, no. 4199 (tree 70 ft. high); in garden of Mr. Chas. Jones, mouth of Carbon R., Aug. 2, no. 4305 (young tree about 20 ft. high); ravine in high river bluff N. W. of Hudson Hope, June 19, no. 3620 (tree 90 ft. high); dry slope of river bluff at Taylor Flat, June 12, no. 3546 (tree about 50 ft. high); woods along Peace R. 10 mi. above Carcasson Settlement, Aug. 15, nos. 4390, 4391 (tall trees 60—80 ft. high). Of the above specimens, all but one, no. 4195, show fruiting cones.

**Picea Engelmanni** (Parry) Engelm.

Specimens doubtfully determined as this species were collected along Carbon R. about 4 mi. above the Peace, Aug. 2, no. 4306. They have a slight but distinct, glandular pubescence on the twigs, and the rather soft, easily-crushed cone-scales of typical *P. Engelmanni* but the cone-scales are not at all erose.

**Picea mariana** (Mill.) B. S. P. — *P. nigra* Link.

Muskeg along Carbon R. about 4 mi. above the Peace, Aug. 2, no. 4263 (tree about 25 ft. high).

*PSEUDOTSUGA DOUGLASII* Carr.

McLeod L., *Dawson*.

**Abies lasiocarpa** Nutt.

Near small lake on W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4193 (stunted tree 3½ ft. high); dry woods along Wicked R. near the Peace, July 30, no. 4241 (tree about 40 ft. high). In the second of these nearly all the cone-scales had fallen off; the first was sterile. — *Mrs. Henry*, 1932 (no data) (P).

**Larix laricina** (Du Roi) K. Koch. — *L. americana* Michx.

Pine woods on bench-land S. of Peace R. at Hudson Hope, alt. about 1600 ft., June 21, no. 3645, June 28, no. 3715 (trees about 60 ft. high). In fruit. — Dease R., lat. 59°, *Dawson*, no. 24983 (O); Lesser Slave L. district, *Brinkman*, no. 4003 (N); *Mrs. Henry* (no data) (P).

**Pinus contorta** Loudon var. *latifolia* Engelm. — *P. Murrayana* Balf. — *P. contorta* var. *Murrayana* (Balf.) Engelm.

Upper part of scrub timber, N. W. slope of Mt. Selwyn, alt. about 4000 ft., July 19, no. 4061 (stunted tree about 10 ft. high); rich woods along Wicked R. near the Peace, July 30, no. 4240 (tall tree); sandy ridge at Hudson Hope, June 23, no. 3683 (trees 40—60 ft. high); upland woods N. of Dawson Creek, June 9, no. 3543 (trees 40—60 ft. high). All bearing fruiting cones. — Near Lesser Slave L., *John Macoun*, no. 25178 (O) ?.

**PINUS BANKSIANA** Lamb.

Lower Liard R., *Dawson* (after *McConnell*), 1887.

**PINUS ALBICAULIS** Engelm. — *Apinus albicaulis* (Engelm.) Rydb.

Reported on the headwaters of the Parsnip R., lat. 54° 30' (See Whitford and Craig, *Forests of British Columbia*, 78).

**Juniperus communis** L. var. **montana** Ait. — *J. sibirica* Burgsd.

Wooded slope at base of Mt. Selwyn near mouth of Quartz Cr., July 21, no. 4001; dry gravelly slope of river bluff at Taylor Flat, June 12, no. 3544. Depressed shrub. Number 3544 with staminate flowers, the other in fruit.

**Juniperus horizontalis** Moench. — *Sabina horizontalis* (Moench) Rydb.

Dry upper slope of river bluff at Taylor Flat, June 12, no. 3571; bluff along Peace R., 10 mi. above Carcajou Settlement, Aug. 15, no. 4389. Number 3571 is sterile, the other is in fruit.

## TYPHACEAE

**TYPHA LATIFOLIA** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

## SPARGANIACEAE

**SPARGANIUM SIMPLEX** Huds. — probably *S. MULTIPEDUNCULATUM* (Morong) Rydb. or *S. ANGUSTIFOLIUM* Michx. — See Rhod. xxvii. 190 (1925).

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Sparganium angustifolium** Michx. — See Rhod. xxiv. 26 (1922).

Upland slough pond near Hudson Hope, June 27, no. 3709. Sterile plants only.

## POTAMOGETONACEAE

**Potamogeton natans** L.

Upland slough margin near W. end of Rocky Mt. Portage, Aug. 3, no. 4313. Sterile plants creeping on the drying surface of the muck.

**Potamogeton tenuifolius** Raf. — *P. alpinus* of Amer. auth. See Rhod. xxxiii. 209 (1931).

Lesser Slave L. district, *Brinkman*, no. 4541 (N).

**Potamogeton gramineus** L. var. **graminifolius** Fries. — *P. heterophyllum* of most recent Amer. auth., not Schreb. — See Rhod. xxiii. 189 (1921).

Slough along Peace R., about 6 mi. below the Wicked R.,

July 22, no. 4038. Plant sterile, creeping on the mud. — Lesser Slave L. district, *Brinkman*, no. 3909 (C).

**POTAMOGETON PERFOLIATUS** L. — probably *P. RICHARDSONII* (A. Benn.) Rydb.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Potamogeton pusillus** L. var. **mucronatus** (Fieber) Graebn.

See Mem. Amer. Acad. Arts & Sci. xvii. pt. 1, 87—9 (1932).

Shallow water of slough pond near W. end of Rocky Mt. Portage, Aug. 3, no. 4314. Sterile. — McLeod L., *John Macoun*, no. 4139 (O).

**Potamogeton foliosus** Raf. var. **macellus** Fern. — See Mem. Amer. Acad. Arts & Sci. xvii. pt. 1, 46—51 (1932).

Lesser Slave L. district, *Brinkman*, no. 3906 (C).

**Potamogeton filiformis** Pers. var. **borealis** (Raf.) St. John.

See Rhod. xviii. 134 (1916).

Peace R. Landing, *J. M. Macoun*, no. 61283 (G, O).

**POTAMOGETON PECTINATUS** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

#### SCHEUCHZERIACEAE

**Triglochin palustre** L.

Muskeg along Carbon R., about 4 mi. above the Peace, Aug. 2, no. 4294. In fruit.

**Triglochin maritimum** L.

McLeod L., *John Macoun*, no. 28174 (O); Peace R. Landing, *J. M. Macoun*, no. 61282 (N, O).

#### ALISMACEAE

**Sagittaria cuneata** Sheldon. — *S. arifolia* Nutt.

Upland slough margin near W. end of Rocky Mt. Portage, Aug. 3, no. 4334. In flower. — Lesser Slave L. district, *Brinkman*, no. 4538 (N).

**Alisma Plantago-aquatica** L. subsp. **brevipes** (Greene) Samuels. — See Arkiv för Botanik, xxiv. 3. 19—21 (1932).

Lesser Slave L. district, *Brinkman*, no. 4647 (N).

#### GRAMINEAE

**Bromus ciliatus** L.

Cabin clearing at mouth of Wicked R., July 31, no. 4247. In anthesis. — Bear Cr., W. of Spirit R., *J. M. Macoun*, no. 59554 (G, O).

**Bromus Richardsonii** Link.

Upper part of scrub timber, W. slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4160. In anthesis.

**Bromus Pumpellianus** Scribn.

Cabin clearing at mouth of Wicked R., July 31, no. 4244; bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4361. The specimens in no. 4244 are in anthesis; the others have maturing spikelets. — Halfway R. near Horseshoe Cr., *Mrs. Henry*, no. 217 (P).

**Festuca brachyphylla** Schultes.

Stony soil, summit of Mt. Selwyn, alt. about 7000 ft., July 19, no. 3985; W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, nos. 3923, 3986; dry river bluff at Hudson Hope, June 29, no. 3731. All collected in anthesis, those from the summit of the mountain being very young, densely caespitose, and having very short culms. — Mt. summit N. of St. Paul's L., alt. 6700 ft., *Mrs. Henry*, no. 133 (P).

**FESTUCA OVINA** L.

Hudson Hope district, *Raup*, 1932.

**Festuca vivipara** (L.) Sm.

Damp alpine slopes of Mt. Selwyn. Alt. 4—5000 ft., July 19, no. 3957; near small lake, alt. about 5000 ft., July 26, no. 4099. Spikelets with well-developed projections of the lemmas.

**Festuca altaica** Ledeb.

West slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3956. In anthesis. — Frances R., lat. 61°, *Dawson*, no. 29626 (O); Finlayson L., lat. 62°, *Dawson*, no. 62734 (O). The Dawson specimens are under *F. scabrella* in Macoun's Cat.

**FLUMINIA FESTUCACEA** (Willd.) Hitchc. — *Scolochloa festucacea* (Willd.) Link. — *Festuca borealis* Mert. & Koch.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872 (noted as *Festuca borealis*).

**Glyceria striata** (Lam.) Hitchc. var. **stricta** (Scribn.) Fern. — *Panicularia nervata* (Willd.) Ktze. var. *stricta* Scribn. — *P. rigida* (Nash) Rydb. — See Proc. Biol. Soc. Wash. xli. 157 (1928); Rhod. xxxi. 47 (1929).

Flood plain slough along Peace R. about 6 mi. below the mouth of the Wicked R., July 22, no. 4033; muskeg slough along Carbon R., Aug. 2, no. 4287; wet ground in timbered ravine on high river bluff N. W. of Hudson Hope, June 27, no. 3707. The Hudson Hope specimen has a very young inflorescence; the others

are in late anthesis. — Dunvegan, *J. M. Macoun*, no. 59551 (G, N, O).

**GLYCERIA AQUATICA** Smith. — probably *G. GRANDIS* or one of its close relatives.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Glyceria pulchella** (Nash) K. Sch. — *Panicularia pulchella* Nash.

Margin of upland slough near Hudson Hope, June 27, no. 3706; slough along Peace R., 10 mi. above Carcassou Settlement, Aug. 15, no. 4357. The first in early anthesis, the second with maturing spikelets. — Dunvegan, *J. M. Macoun*, no. 59550 (O, N).

**Glyceria pauciflora** Presl. — *Panicularia pauciflora* (Presl) Ktze.

Lesser Slave L., *John Macoun*, no. 29565 (O).

**Glyceria borealis** (Nash) Batchelder. — *Panicularia borealis* Nash.

Margin of slough near W. end of Rocky Mt. Portage, Aug. 3, no. 4315. Maturing spikelets.

**GLYCERIA AIROIDES** Thurb. — probably *PUCCINELLIA NUTTALLIANA* (Schultes) Hitchc.

Saline springs along Peace R. above the Smoky, *John Macoun*, 1875.

**Poa alpina** L.

Stony soil, summit of Mt. Selwyn, July 19, no. 3902; W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3984, and July 26, no. 4148; wet sandy shore of small lake, W. slope of Mt. Selwyn, alt. 5000 ft., July 26, no. 4102; quartz ridge, N. W. slope of Mt. Selwyn, July 23, no. 4066c.; sandy and stony shores of the Peace and Wicked Rivers in the vicinity of Mt. Selwyn, July 14—18, nos. 3812, 3862, 3885; cabin-clearing at mouth of Quartz Cr., July 29, no. 4220. All collected in various stages of anthesis. Most of the alpine specimens are small, with culms 2—12 in. tall, while those of the river banks commonly grow 18—20 in. tall. — McLeod L., *John Macoun*, no. 29289 (O).

**Poa laxa** Haenke.

Stony soil on summit of Mt. Selwyn, July 19, no. 3903. In anthesis.

**Poa glacialis** Scribn. & Merrill.

Damp grassy slopes of Mt. Selwyn. Near small lake, alt. about 5000 ft., July 26, no. 4097; alt. about 4500 ft., July 26, no. 4147.

Both specimens in anthesis. — Laurier Pass, alt. 4000 ft., *Mrs. Henry*, no. 180 (P).

**Poa reflexa** Vasey & Scribn.

Hills N. of Finlayson L., *Dawson*, no. 29140 (O). *P. cenisia* of Macoun's Cat.

**Poa glauca** L.

Turfy slopes and rock crevices, Mt. Selwyn, alt. 4—5000 ft., July 19, nos. 3922, 3924, 3955; limestone rock slide near the Peace R., opposite Mt. Selwyn, July 22, no. 4011; steep dry slope of bluff along Maurice Cr., S. of Hudson Hope, June 21, no 3648; dry bluff along Peace R., 10 mi. above Carcajou Settlement, Aug. 15, no. 4367. Those collected on the upper Peace are all in various stages of anthesis; the Carcajou plants are with maturing spikelets. — McLeod L., *John Macoun*, no. 29050 (O); Dease R., lat. 59°, *Dawson*, no. 101816 (O); Frances R., lat. 61°, *Dawson*, no. 101817 (O). The Dawson and Macoun specimens are under *P. caesia* in Macoun's Cat.

**Poa palustris** L. — *P. triflora* of auth. — See Rhod. xviii. 235 (1916).

Cabin clearing at mouth of Quartz Cr., July 29, no. 4218. In anthesis. — Dunvegan, *J. M. Macoun*, no. 59542 (G, N, O).

**Poa nemoralis** L.

Dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4373. Maturing spikelets.

**Poa scabrella** (Thurb.) Benth.

McLeod L., *John Macoun*, no. 29041 (O).

**Poa pratensis** L.

Damp sandy bank of Wicked R., July 18, no. 3884; cabin clearing at Quartz Cr., July 29, no. 4217; prairie opening near Hudson Hope, June 23, no. 3680. In various stages of anthesis.

**CATABROSA AQUATICA** Beauv. — probably *C. AQUATICA* var. *UNIFLORA* S. F. Gray. — See Rhod. xxxv. 138—40 (1933).

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**DISTICHLIS SPICATA** (L.) Greene. — *Brizopyrum spicatum* Hook. & Arn. — See Rhod. xxvii. 67 (1925).

Saline springs along Peace R. above the Smoky, *John Macoun*, 1875 (noted as *Brizopyrum spicatum*).

**PHRAGMITES COMMUNIS** Trin.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872; saline springs along Peace R. above the Smoky, *John Macoun*, 1875 (as *P. arundinacea*).

**Schizachne purpurascens** (Torr.) Swallen. — *Avena striata* Michx. — *Bromelica striata* (Michx.) Farwell. — *Melica purpurascens* (Torr.) Hitchc. — See Jour. Wash. Acad. Sci. xviii. 203 (1928).

Poplar thickets, Hudson Hope, June 29, no. 3733; along Rocky Mt. Portage near Hudson Hope, Aug. 4, no. 4342. The first is in anthesis; the second has mature spikelets. — Dunvegan, *J. M. Macoun*, no. 59548 (G, N, O).

**Agropyron trachycaulum** (Link) Steud. var. **typicum** Fern. — *A. tenerum* Vasey. — See Rhod. xxxv. 161—82 (1933) for a treatment of this and the two following forms.

Sandy shore of Peace R. at mouth of Quartz Cr., July 29, no. 4222; dry bluff along Peace R., 10 mi. above Carcajou Settlement, Aug. 15, no. 4376. The first is in early anthesis; the second in fruit. — Dunvegan, *J. M. Macoun*, no. 59547 (G, N, O).

**Agropyron trachycaulum** (Link) Steud. var. **unilaterale** (Cassidy) Malte. — *A. Richardsonii* Schrad.

Cabin clearing at mouth of Wicked R., July 31, no. 4243; dry bluff along Peace R., 10 mi. above Carcajou Settlement, Aug. 15, no. 4375. The first is in anthesis; the other with maturing spikelets. — Dunvegan, *J. M. Macoun*, no. 59546 (G, N, O).

**Agropyron trachycaulum** (Link) Steud. var. **novae-angliae** (Scribn.) Fern.

Sandy river banks near mouth of the Wicked R. July 16, no. 3866; July 31, no. 4259. Both are in anthesis.

**Agropyron dasystachyum** (Hook.) Vasey.

Dry slope of high bluff N. of Hudson Hope, June 23, no 3681. In anthesis.

**Elymus canadensis** L.

Sandy bank of Peace R. about 100 mi. below Taylor Flat, Aug. 8, no. 4392. In anthesis. — Dunvegan, *J. M. Macoun*, no. 59543 (G, N, O).

**ELYMUS SIBIRICUS** L. — possibly *E. GLAUCUS* Buckley.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Elymus Macounii** Vasey.

Dunvegan, *J. M. Macoun*, no. 59545 (G, N, O).

**Elymus innovatus** Beal.

Cabin clearing at mouth of Wicked R., July 31, no. 4245. In anthesis. — Dunvegan, *J. M. Macoun*, no. 59544 (O).

**HORDEUM JUBATUM** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Koeleria cristata** (L.) Pers.

Dry slope of high bluff N. of Hudson Hope, June 23, no. 3679.  
In anthesis.

**Trisetum spicatum** (L.) Richter.

Western slope of Mt. Selwyn. Alt. 4—5000 ft., July 19, no. 3977; near small lake, alt. about 5000 ft., July 26, no. 4095. The first with very young inflorescences; the second in anthesis.

**Trisetum spicatum** (L.) Richter var. **molle** (Michx.) Beal.

— *T. subspicatum* (L.) Beauv. var. *molle* Gray. — See Rhod. xviii. 195 (1916) and xxx. 239 (1928).

Western slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3926; sandy shores near mouth of Wicked R., July 16, no. 3861; cabin clearing at mouth of Quartz Cr., July 29, no. 4219. In anthesis. — McLeod L., *John Macoun*, no. 28928 (O); upper Liard R., lat. 60°, *Dawson*, no. 28931 (O); Frances L., lat. 61°, *Dawson*, no. 28932 (O); hills N. of Finlayson L., *Dawson*, no. 101794 (O).

**Avena fatua** L. var. **glabrata** Peterm.

Dunvegan, *J. M. Macoun*, no. 59555 (O).

**Melica spectabilis** Scribn.

McLeod L., *John Macoun*, no. 29478 (O).

**Deschampsia cespitosa** (L.) Beauv. var. **glaucia** (Hartm.)

Lindm. — See Rhod. xxviii. 154 (1926).

Sandy shore of small lake on W. slope of Mt. Selwyn, alt. 5000 ft., July 26, no. 4089; sandy shore of Peace R. at mouth of Quartz Cr., July 29, no. 4221. The Mt. Selwyn specimens with very young inflorescences, the others in anthesis. — Rat Cr., W. of Spirit R., *J. M. Macoun*, no. 59552 (O).

**DANTHONIA SERICEA** Nutt. — possibly *D. THERMALIS* Scribn.

Ft. St. John, *John Macoun*, 1875.

**Danthonia intermedia** Vasey.

Mossy places on sandy shore at mouth of Wicked R., July 31, no. 4260. In anthesis.

**Calamagrostis purpurascens** R. Br.

Rock crevices on W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3919; sandy river banks near mouth of Wicked R., July 16, no. 3865. In anthesis. No. 3919 has unusually long spikelets (some over 1 cm.). — Dease L., lat. 59°, *Dawson*, no. 101777 (O) (*Deyeuxia sylvatica* of Macoun's Cat.).

**Calamagrostis canadensis** (Michx.) Nutt. var. **robusta** Vasey. — See Rhod. xxiv. 142 (1922); xxxii. 42 (1930).

Margin of slough along the Peace R. about 6 mi. below the Wicked R., July 22, no. 4026; edge of cabin clearing, sandy shore of Peace R. at mouth of Quartz Cr., July 29, no. 4223. In anthesis. — McLeod L., *John Macoun*, no. 17346 (O).

**Calamagrostis canadensis** (Michx.) Nutt. var. **Langsdorfi** (Link) Inman. — *C. Langsdorfi* (Link) Trin. — See Rhod. xxiv. 142—4 (1922).

McLeod L., *John Macoun*, no. 17386 (O).

**Calamagrostis inexpansa** Gray var. **brevior** (Vasey) Stebbins. — See Rhod. xxxii. 50 (1930).

Margin of muskeg along Carbon R., Aug. 2, no. 4286. In anthesis. — W. of Spirit R., *J. M. Macoun*, no. 59553 (N, O).

**Agrostis scabra** Willd. — See Rhod. xxxv. 207—12 (1933).

Slough along Peace R. about 6 mi. below the Wicked R., July 22, no. 4018. In anthesis.

**Cinna latifolia** (Trev.) Griseb.

Rich woods and cabin clearing along Peace R. at mouth of Quartz Cr., July 29, no. 4197. In early flower.

**Arctagrostis arundinacea** (Trin.) Beal.

Cabin clearing at mouth of Wicked R., July 31, no. 4246. In anthesis.

**Alopecurus aequalis** Sobol. — *A. aristulatus* Michx. — *A. geniculatus* L. var. *aristulatus* (Michx.) Torr.

Slough along Peace R. about 6 mi. below the Wicked R., July 22, no. 4020. In late anthesis and early fruit. — McLeod L., *John Macoun*, no. 30174 (O).

**Phleum alpinum** L.

Damp meadows and thickets on W. slope of Mt. Selwyn near small lake, alt. about 5000 ft., July 26, no. 4151. With young flowers.

**Phleum pratense** L.

Sandy river banks near mouth of Wicked R., July 16, no. 3851; cabin clearing at mouth of Wicked R., July 31, no. 4249; meadow at Hudson Hope, June 29, no. 3732. No. 4249 is in anthesis; the others are in young flower.

**VILFA CUSPIDATA** Trin. — probably **MUHLENBERGIA CUSPIDATA** (Torr.)

Rydb. or **M. RICHARDSONIS** (Torr.) Rydb.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**MUHLENBERGIA GLOMERATA** Trin. — possibly *M. RACEMOSA* (Michx.) B.S.P.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Oryzopsis pungens** (Torr.) Hitchc.

Pine timber on sand ridge at Hudson Hope, June 16, no. 3608.

In flower.

**Oryzopsis micrantha** (Trin. & Rupr.) Thurb.

Dry bluff along Peace R., 10 mi. above Carcajou Settlement, Aug. 15, no. 4368. With mature fruit.

**Oryzopsis asperifolia** Michx.

Rich woods along Wicked R., near the Peace R., July 14, no. 3820. In anthesis.

**Oryzopsis hymenoides** (R. & S.) Ricker. — *Eriocoma hymenoides* (R. & S.) Rydb.

Lesser Slave L. district, *Brinkman*, no. 4618 (C).

**Stipa comata** Trin. & Rupr.

Dry slope of high bluff N. of Hudson Hope, June 23, no. 3677; top of dry river bluff at Taylor Flat, June 12, no. 3564; dry river bluff along Peace R., 10 mi. above Carcajou Settlement, Aug. 15, no. 4366. The Hudson Hope specimens have maturing fruit; no. 3564 has very young inflorescences; and the last is well past maturity.

**Stipa viridula** Trin.

Dry slope of high bluff N. of Hudson Hope, June 23, no. 3678; dry bluff along Peace R., 10 mi. above Carcajou Settlement, Aug. 15, no. 4366a. No. 3678 with young inflorescences; the other maturing its spikelets. — Dunvegan, *J. M. Macoun*, no. 59549 (O).

**Beckmannia Syzigachne** (Steud.) Fern. — *B. erucaeformis* Amer. auth., not Host. — *B. baicalensis* (W. Kuznetzow) Hulten. — See Rhod. xxx. 27 (1928).

Slough along Peace R., 10 mi. above Carcajou Settlement, Aug. 15, no. 4356. In fruit.

**SPARTINA GRACILIS** Trin.

Saline springs along Peace R. above the Smoky, *John Macoun*, 1875.

**SPARTINA POLYSTACHYA** Hook. — probably *S. PECTINATA* Bosc.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Hierochloë alpina** (Liljebl.) R. & S.

Finlayson R., lat. 61° 30', *Dawson*, no. 29501 (O).

**Hierochloë odorata** (L.) Wahl. — *Torresia odorata* (L.) Hitchc.

Sandy bank of Wicked R. near the Peace R., July 18, no. 3881; cabin clearing at mouth of Wicked R., July 31, no. 4248; meadow on top of river bluff at Taylor Flat, June 12, no. 3565. In various stages of flowering. — McLeod L., *John Macoun*, no. 29495 (O); upper Liard R., lat. 60°, *Dawson*, no. 29496 (O). The Dawson and Macoun specimens are cited under *H. borealis* in Macoun's Cat.

**PHALARIS ARUNDINACEA** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

CYPERACEAE

**Eriophorum Chamissonis** C. A. Mey. forma **albidum** (F. Nyl.) Fern. — See Rhod. xxvii. 207 (1925), and xxiii. 131 (1921).

Near source of Akie R., alt. 4200 ft., *Mrs. Henry*, no. 557 (P) (1933).

**Eriophorum opacum** (Bjornstr.) Fern. — See Rhod. xxvii. 203—10 (1925).

Springy slope in spruce woods, ravine in high bluff N. W. of Hudson Hope, June 16, no. 3592, and June 27, no 3703. Maturing fruits.— East of Stewart L., *John Macoun*, no. 32292 (O) (*E. vaginatum* of Macoun's Cat.); Lesser Slave L. district, *Brinkman*, nos. 4138, 4156 (N).

**Eriophorum callitrix** Cham.

Mountain near Akie R., alt. 5000 ft., *Mrs. Henry*, no. 578 (P) (1933).

**Eriophorum spissum** Fern. — *E. callitrix* of most Amer. auth. — See Rhod. xxvii. 208 (1925).

MacAllister Cr., N. of Dunvegan, *J. M. Macoun*, no. 59541 (G, N, O)

**Eriophorum gracile** Koch.

Lesser Slave L. district, *Brinkman*, no. 4542 (N).

**Eriophorum viridicarinatum** (Engelm.) Fern.

Muskeg along Carbon R., Aug. 2, no. 4300. With maturing fruits.

**Scirpus cespitosus** L. var. **callosus** Bigelow. — See Rhod. xxiii. 22 (1921).

Muskeg along Carbon R., Aug. 2, no. 4275. With mature fruit.

**Scirpus validus** Vahl.

Lesser Slave L. district, *Brinkman*, no. 4607 (N).

**SCIRPUS MARITIMUS** L. — possibly *S. PALUDOSUS* A. Nels.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872; saline springs along Peace R. above the Smoky, *John Macoun*, 1875.

**Scirpus microcarpus** Presl.

Lesser Slave L. district, *Brinkman*, no. 3873 (N).

**SCIRPUS ATROVIRENS** Muhl. — possibly *S. MICROCARPUS* Presl or *S. RUBROTINCTUS* Fern.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Eleocharis palustris** (L.) R. & S.

Margin of slough near W. end of Rocky Mt. Portage, Aug. 3, no. 4330. With maturing fruit. — Lesser Slave L. district, *Brinkman*, no. 4615 (N).

**ELEOCHARIS ACICULARIS** (L.) R. & S.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Carex nardina** Fries var. **Hepburnii** (Boott) Kükenth.

Stony soil, summit of Mt. Selwyn, July 19, no. 3904; W. slope of Mt. Selwyn, alt. about 5000 ft., July 13, no. 3780; W. slope, alt. 4—5000 ft., July 19, nos. 3916, 3918. All in various stages of flower and young fruit.

**Carex gynocrates** Wormsk.

Muskeg along Carbon R., Aug. 2, no. 4276. Maturing fruits. — Lesser Slave L. district, *Brinkman*, no. 4552 (N).

**CAREX DOUGLASII** Boott.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Carex stenophylla** Wahl.

Top of dry river bluff at Taylor Flat, June 12, nos. 3559, 3560, 3574. In flower.

**CAREX MARCIDA** Boott. — probably *C. PRAEGRACILIS* W. Boott.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Carex siccata** Dewey.

Spruce woods in ravine on high bluff N. W. of Hudson Hope, June 16, no. 3593a; open pine woods on sandy ridges at Hudson Hope, June 20, no. 3630; high river bluff S. of the Peace R. at Hudson Hope, June 28, no. 3724. With flowers or young fruit. — White Mud Cr., *J. M. Macoun*, no. 59536 (G, N, O); Lesser Slave L. district, *Brinkman*, nos. 4250, 4276, 4391 (N).

**Carex Hoodii** Boott.

McLeod L., *John Macoun*, nos. 98564 (G, O), 31216 (O).

**Carex vulpinoidea** Michx.

Lesser Slave L. district, *Brinkman*, no. 4614 (N).

**Carex diandra** Schrank.

Margin of upland slough near Hudson Hope, June 27, no. 3705; wet meadow near W. end of Rocky Mt. Portage, Aug. 3, no. 4325. Both with maturing fruit.

**Carex stipata** Muhl.

Lesser Slave L. district, *Brinkman*, no. 4345 (N).

**Carex laeviculmis** Meinsh.

White Mud R., *J. M. Macoun*, no. 59539 (O).

**Carex interior** Bailey.

Muskeg along Carbon R., Aug. 2, no. 4268. In fruit.

**Carex Deweyana** Schw.

Spruce woods near upper end of Rocky Mt. Canyon, July 7, no. 3753; rich lowland woods S. of the Peace R. at Hudson Hope, July 21, no. 3647. In flower. — Lesser Slave L. district, *Brinkman*, nos. 4291, 4337 (N).

**Carex Crawfordii** Fern.

Wet meadow near W. end of Rocky Mt. Portage, Aug. 3, no. 4327. With young fruit. — Rat Cr., S. of Peace R., *J. M. Macoun*, no. 59526, in part, (G, N, O); Lesser Slave L. district, *Brinkman*, nos. 4027, 4053, 4348, 4553 (N).

**Carex Bebbii** Olney.

Slough along Peace R. about 6 mi. below the Wicked R., July 22, no. 4034; slough along Rocky Mt. Portage near Hudson Hope, Aug. 4, no. 4339. In various stages of flower and young fruit. — Bear Cr., S. of Peace R., *J. M. Macoun*, no. 59525 (G, N, O); Rat Cr., S. of Peace R., *J. M. Macoun*, no. 59526, in part (N); Lesser Slave L. district, *Brinkman*, no. 4644 (N); Grande Prairie, *J. C. Pearse*, Aug. 5, 1905, no. 2 (G).

**Carex phaeocephala** Piper.

Turfy slopes of Mt. Selwyn. Alt. 4—5000 ft., July 19, no. 3961; alt. about 4000 ft., July 26, nos. 4144, 4162. All in flower, with the last showing young fruit.

**Carex praticola** Rydb. — *C. pratensis* Drejer.

Rich lowland woods S. of the Peace R. at Hudson Hope, June 21, no. 3649; grazed meadow near Dawson Creek, June 8, no. 3526. Both in flower, the first very young. — McAllister Cr., *J. M. Macoun*, no. 59529 (G, N, O); Lesser Slave L. district, *Brinkman*, no. 4313 (N).

**Carex festivella** Mackenzie.

Along Rocky Mt. Portage road, Aug. 4, no. 4344; rich lowland woods S. of the Peace at Hudson Hope, June 21, no 3646; wooded slope of high river bluff S. of the Peace R. at Hudson Hope, June 28, no. 3725. The first in fruit; the others in flower. — McAllister Cr., *J. M. Macoun*, no. 59533 (O).

**Carex xerantica** Bailey.

Burnt R., N. E. of Dunvegan, *J. M. Macoun*, no. 59535 (G, N, O).

**Carex pachystachya** Cham.

Alder thicket in slough along Peace R., about 6 mi. below the Wicked R., July 22, no. 4024. With young fruit. — Lesser Slave L. district, *John Macoun*, no. 31061 (O) (*C. festiva* of Macoun's Cat.), and *Brinkman*, nos. 4308, 4407 (N).

**Carex disperma** Dewey.

Along small brook in wooded ravine on high bluff N. W. of Hudson Hope, June 16, no. 3597. In flower. — McLeod L., *John Macoun*, no. 31931 (O) (*C. tenella* of Macoun's Cat.); McAllister Cr., *J. M. Macoun*, no. 59540 (N, O).

**CAREX TRISPERMA** Dewey.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Carex tenuiflora** Wahl.

Lesser Slave L. district, *Brinkman*, no. 4554 (N).

**Carex loliacea** L.

Lesser Slave L. district, *Brinkman*, no. 4209 (C).

**Carex bipartita** All. — *C. Lachenalii* Schk. — See Bull. Torr. Bot. Club L. 348—9 (1923).

Near small lake on W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4090. In flower.

**Carex canescens** L. var. **subloliacea** Laestad.

McAllister Cr., *J. M. Macoun*, no. 59538 (N, O); Lesser Slave L. district, *Brinkman*, nos. 4280, 4280a, 4427 (N).

**Carex brunnescens** Poir. var. **sphaerostachya** (Tuckerm.) Kükenth. — See Rhod. xxviii. 163 (1926).

McLeod L., *John Macoun*, no. 30472 (O) (?*C. canescens* var. *vulgaris* of Macoun's Cat.); Lesser Slave L. district, *Brinkman*, nos. 4036, 4028, 4177, 4281 (N).

**Carex arcta** Boott.

Lesser Slave L. district, *Brinkman*, no. 4532 (N).

**Carex leptalea** Wahl.

Muskeg along Carbon R., Aug. 2, no. 4292. In fruit.

**Carex obtusata** Liljebl.

Dry slope of high bluff N. of Hudson Hope, June 23, no. 3682a; top of dry river bluff at Taylor Flat, June 12, no. 3558. All are in young fruit.

**Carex deflexa** Hornem.

McLeod L., *John Macoun*, no. 30978 (O) (*C. deflexa* var. *media* of Macoun's Cat.).

**Carex Rossii** Boott.

McLeod L., *John Macoun*, no. 32068 (O) (*C. varia* of Macoun's Cat.); Lesser Slave L. district, *Brinkman*, no. 4179 (C).

**Carex scirpoidea** Michx.

Turfy slope of Mt. Selwyn, alt. about 5000 ft., July 13, no. 3782; Mt. Selwyn, alt. 4—5000 ft., July 19, nos. 3901, 3976; near small lake on W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4126; sandy river banks near mouth of Wicked R., July 16, no. 3863. In flower.

**Carex heliophila** Mackenzie.

Dry slope of high bluff N. of Hudson Hope, June 23, no. 3682; top of dry river bluff at Taylor Flat, June 12, no. 3567; dry grazed meadows near Dawson Creek, June 8, nos. 3521, 3524. All in flower or early fruit.

**Carex Peckii** E. C. Howe.

Lesser Slave L. district, *Brinkman*, no. 4289 (N).

**Carex concinna** R. Br.

Grassy thickets on W. slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4185; rich woods and mossy banks along the Wicked R., July 14, no. 3806, and July 16, no. 3839; rich woods in ravine on high bluff N. W. of Hudson Hope, June 16, no. 3593. All with maturing fruits, the last mainly in flower. — McLeod L., *John Macoun*, no. 30902 (O); Lesser Slave L. district, *Brinkman*, no. 4286 (N).

**Carex Richardsonii** R. Br.

Open pine woods on sandy ridge, Hudson Hope, June 16, no. 3609; top of dry river bluff at Taylor Flat, June 12, no. 3566. Both with flowers and young fruit.

**Carex eburnea** Boott.

Mossy hummocks on sandy shores near mouth of Wicked R., July 16, no. 3864. With maturing fruit.

**Carex Hassei** Bailey.

Damp muddy-sandy bank of the Peace R. near mouth of the Wicked, July 16, no. 3860; muskeg along Carbon R., Aug. 2, no. 4295; springy slope of river bank at Hudson Hope, June 22, no. 3659. The June and July specimens have flowers or immature fruits; the Carbon R. material shows maturing fruits.

**Carex aurea** Nutt.

Damp sandy shore of Peace R. at head of Rocky Mt. Canyon, July 7, no. 3739; rich woods high on south bluff of Peace R. valley at Hudson Hope, June 28, no. 3721; springy slope of river bank at Hudson Hope, June 22, no. 3659a; along Rocky Mt. Portage road near Hudson Hope, Aug. 4, no. 4347; moist meadow near Dawson Creek, June 8, no. 3525. All in flower or very young fruit except no. 4347 which is maturing its fruits. — McLeod L., *John Macoun*, no. 30801 (O); Lesser Slave L. district, *Brinkman*, nos. 3316, 3420, 3897, 4285 (C); Henry R., alt. 4000 ft., *Mrs. Henry*, no. 150 (P).

**Carex vaginata** Tausch.

Muskeg along Carbon R., Aug. 2, no. 4296. In flower. — Lesser Slave L. district, *Brinkman*, nos. 4178, 4190, 4208, 4215 (N).

**Carex capillaris** L.

West slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4073; damp mossy bank of Wicked R., July 16, no. 3838; muskeg along Carbon R., Aug. 2, no. 4293; springy slope of river bank at Hudson Hope, June 22, no. 3658. The June and July specimens have flowers or immature fruits; the later ones are mature. — McLeod L., *John Macoun*, no. 30839 (O).

**Carex abbreviata** Prescott.

White Mud R., *J. M. Macoun*, no. 59537 (O); Burnt R., N. E. of Dunvegan, *J. M. Macoun*, no. 59534 (G, N, O).

**Carex limosa** L.

Muskeg slough near W. end of Rocky Mt. Portage, Aug. 3, no. 4320. With maturing fruits.

**Carex macrochaeta** C. A. Mey.

Liard R., lat.  $62^{\circ}$ , *Dawson*, no. 99788 (O) (*C. podocarpa* of Macoun's Cat.).

**CAREX ARCTICA** Dewey. — probably *C. PARRYANA* Dewey.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Carex Vahlii** Schkuhr var. **inferalpina** (Wahl.) Fern.—  
*C. Halleri* Gunn.—See Rhod. xxxv. 220—3, 398 (1933).

McLeod L., *John Macoun*, no. 30687 (O) (*C. alpina* of Macoun's Cat.); MacAllister Cr., *J. M. Macoun*, no. 59528 (G, N, O); Lesser Slave L. district, *Brinkman*, nos. 4225, 4322 (N).

**Carex albo-nigra** Mackenzie.

Near small lake on W. slope of Mt. Selwyn, July 26, alt. about 5000 ft., no. 4129. In flower.

**Carex atrosquama** Mackenzie.

Turfy slopes of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3948; near small lake on W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4088. In flower and immature fruit.

**Carex bella** Bailey.

McLeod L., *John Macoun*, no. 32114 (O) (*C. vulgaris* var. *alpina* of Macoun's Cat.).

**Carex atratiformis** Britton.

Frances R., lat. 61°, *Dawson*, no. 13422 (O) (*C. atrata* of Macoun's Cat.); McAllister Cr., *J. M. Macoun*, nos. 59530 (G, N, O), 59532 (O).

**Carex lenticularis** Michx.

Slough along Peace R. about 6 mi. below the mouth of the Wicked, July 22, nos. 4019, 4022, 4030. Found in various stages of maturity, from flower to ripe fruit.—McLeod L., *John Macoun*, no. 31169 (O) (*C. vulgaris* of Macoun's Cat.).

**Carex aquatilis** Wahl.

Slough along Rocky Mt. Portage road, Aug. 4, no. 4341. With maturing fruit.—McLeod L., *John Macoun*, no. 30728 (O); McAllister Cr., *J. M. Macoun*, no. 59531 (N, O); Lesser Slave L. district, *Brinkman*, no. 3956 (C).

**CAREX TRICHOCARPA** Muhl. var. **ARISTATA** (R.Br.) Bailey.—*C. atherodes* Spreng.

Near Rocky Mountain Portage road, *Raup*, 1932.

**Carex flava** L.

Slough along Peace R. about 6 mi. below the Wicked R., July 22, no. 4025. With maturing fruit.

**Carex ambusta** Boott.

Damp turf slopes on Mt. Selwyn. Alt. 4—5000 ft., July 19, no. 3921; alt. about 4500 ft., July 26, nos. 4145, 4157. All in flower, those of July 19 very young.—Frances R., lat. 61°, *Dawson*, no. 13413 (O).

**Carex rostrata** Stokes.

Slough along Peace R. about 6 mi. below the Wicked R., July 22, no. 4032; upland slough near Hudson Hope, June 27, no. 3704; slough along Peace R., 10 mi. above Carcajou Settlement, Aug. 15, no. 4353. The Hudson Hope specimens are in flower; the others have maturing fruits. — Rat R., S. of Peace R., *J. M. Macoun*, no. 59527 (N, O); Lesser Slave L. district, *Brinkman*, no. 3954 (N).

**Carex retrorsa** Schw.

Alder thicket in slough along Peace R. about 6 mi. below the Wicked, July 22, no. 4023. In flower.

## ARACEAE

**Calla palustris** L.

Lesser Slave L. district, *Brinkman*, no. 4248 (N).

## LEMNACEAE

**LEMNA MINOR** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**LEMNA TRISULCA** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

## JUNCACEAE

**JUNCUS BUFONIUS** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Juncus oronensis** Fern.

Lesser Slave L., *John Macoun*, no. 27936 (O) (*J. tenuis* var. *secundus* of Macoun's Cat.); Notikewin, *Moss*, no. 2275 (G).

This species was originally described from specimens collected in Maine (Rhod. vi. 36—38, 1904) and has long been considered endemic in that region.

**Juncus Vaseyi** Engelm.

Margin of upland slough near Hudson Hope, June 27, no. 3708; slough along the Rocky Mt. Portage road near Hudson Hope, Aug. 4, no. 4343. The June specimens have only young shoots with the dried fruiting stems of the preceding year; those of August 4 are just beginning to mature their capsules. — Bear Cr., N. of Smoky R. Mission, *J. M. Macoun*, no. 61281 (G, O); Lesser Slave L. district, *Brinkman*, no. 3937 (N).

**Juncus arcticus** Willd.

Muddy shore of Carbon R., about 4 mi. above the Peace, Aug. 2, no. 4264. With flowers and maturing capsules. An extremely slender form of the species with culms as much as 5 dm. tall.

**Juncus balticus** Willd. var. **littoralis** Engelm.

Slough along Rocky Mt. Portage road, Aug. 4, no. 4348. In flower. — Lesser Slave L. district, *Brinkman*, no. 4611 (N).

**Juncus Drummondii** E. Meyer.

Damp turf slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4085. In flower.

**Juncus filiformis** L.

Lesser Slave L. district, *John Macoun*, no. 62393 (O), and *Brinkman*, no. 4357 (N).

**Juncus nodosus** L.

Slough along Peace R. about 6 mi. below the Wicked R., July 22, no. 4035. In flower. — Lesser Slave L. district, *Brinkman*, nos. 3884, 4610 (N).

**Juncus alpinus** Vill.

Slough along Peace R. about 6 mi. below the Wicked R., July 22, nos. 4031, 4036; slough along Rocky Mt. Portage road near Hudson Hope, Aug. 4, no. 4340. In flower.

**Juncus Mertensianus** Bong.

Near Cypress Cr., alt. 3500 ft., *Mrs. Henry*, (P) (1933).

**Luzula parviflora** (Ehrh.) Desv. — *Juncoides parviflorum* (Ehrh.) Coville.

Damp mossy places on the slopes of Mt. Selwyn, alt. 3—5000 ft., those in the upper part of the timber on exposed ledges, July 13, no. 3833; July 26, no. 4156, and near small lake, no. 4098. In flower. — McLeod L., *John Macoun*, no. 28031 (O); N. of Finlayson L., *Dawson*, no. 62462 (O). Macoun and Dawson specimens are *L. parviflora* var. *melanocarpa* of Macoun's Cat.

**Luzula campestris** (L.) DC. var. **congesta** (Thuill.) Meyer.

McLeod L., *John Macoun*, ? no. 27985 (O) (*L. comosa* var. *congesta* of Macoun's Cat.).

**Luzula campestris** (L.) DC. var. **frigida** Buch.

McLeod L., *John Macoun*, no. 62457 (O).

**Luzula campestris** (L.) DC. var. **comosa** (Meyer) Fern. & Wieg.

Lesser Slave L. district, *Brinkman*, no. 4287 (N).

**Luzula spicata** (L.) DC. — *Juncoides spicata* (L.) Ktze.

Damp mossy slopes and ledges on Mt. Selwyn, alt. 4—5000 ft. July 19, no. 3965; near small lake, July 26, no. 4146. In flower.

## LILIACEAE

**Tofieldia palustris** Huds. — *T. minima* (Hill) Druce. — See Bot. Exch. Cl. Brit. I. 1913, p. 439.

Damp mossy slopes and ledges, W. slope of Mt. Selwyn near small lake, alt. about 5000 ft., July 26, no. 4092; wet mossy bank of Wicked R., near the Peace R., July 16, no. 3840. The Mt. Selwyn specimens are in flower, those from the Wicked R. have immature capsules. — Bank of Sikanni R., alt. 3500 ft., *Mrs. Henry*, no. 26 (P); bank of Musqua R., alt. 2600 ft., *Mrs. Henry*, no. 73 (P).

**Tofieldia glutinosa** (Michx.) Pers.

Muskeg along Carbon R., Aug. 2, no. 4297. With flowers and immature fruits. Rydberg, in 1900, gave the name *T. intermedia* (Bull. Torr. Bot. Cl. xxvii. 528) to the Rocky Mountain members of this group, stating that they differed from the eastern *T. glutinosa* in having sepals "ovate, 4—5 mm. long: petals somewhat narrower and longer", and a dense inflorescence with rather short pedicels, as against sepals and petals "oblong subequal" and a more or less open, elongated inflorescence. The Carbon R. specimens cited above, however, match very well the *T. glutinosa* of northeastern North America from which came Michaux's type (Lake Mistassini). It should also be noted that the other northwestern material in the Gray Herbarium matches the eastern equally well. — Lake Mary, *Mrs. Henry*, no. 142 (P).

**Zygadenus elegans** Pursh. — *Anticlea elegans* (Pursh) Rydb.

Damp turf slopes on Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3920; grassy openings in woods along the Wicked R., July 16, no. 3835. In flower. — Mt. N. of St. Paul's L., alt. 5500 ft., *Mrs. Henry*, no. 127 (P); Pink Mt., alt. 4000 ft., *Mrs. Henry*, no. 237 (P).

**Veratrum Eschscholtzianum** (R. & S.) Rydb.

In damp gullies on the slopes of Mt. Selwyn, alt. 4—5000 ft., usually in thickets, July 26, no. 4177. In flower. — Head of Sukunka R., *Sheldon and Borden*.

**Allium Schoenoprasum** L. var. **sibiricum** (L.) Hartm. — *A. sibiricum* L.

Damp sandy and gravelly banks of the Peace R. near the mouth of Quartz Cr., July 21, no. 4002, and July 29, no. 4205; top of dry river bluff at Taylor Flat, June 12, no. 3556. The June specimen is in bud, the others in flower. — Frances R., lat. 61°,

Dawson, no. 27425 (O) (*A. Schoenoprasum* of Macoun's Cat.); bank of Peace R., alt. 2000 ft., *Mrs. Henry*, no. 162 (P).

**Allium cernuum** Roth.

Dunvegan, ? *John Macoun*, 1879, no. 27405 (O). Although ascribed to John Macoun, this is probably a Dawson specimen (See page 17).

**Lilium philadelphicum** L.

Jenkins L., Alta., *Moss*, no. 2212 (G).

**Lilium philadelphicum** L. var. **andinum** (Nutt.) Ker forma **immaculatum**, forma nov.

A forma typica flore flavo immaculato differt.

This material is peculiar in having lemon-yellow flowers which are devoid of the usual dark spots. — Jenkins L., Alta., *Moss*, no. 2213 (G).

**Clintonia uniflora** (Schultes) Kunth.

Rich woods along the Wicked R. near the Peace R., July 14, no. 3828. In flower. — McLeod L., *John Macoun*, nos. 27476, 27477 (O).

**Smilacina racemosa** (L.) Desf.

Beaverlodge, *Moss*, no. 2302 (G).

**Smilacina amplexicaulis** Nutt. — *Vagnera amplexicaulis* (Nutt.) Morong.

Rich woods along Wicked R. near the Peace R., July 30, no. 4235; woods on slope of high bluff N. W. of Hudson Hope, June 16, no. 3604. The Hudson Hope specimens are in flower; the others have immature fruits. — Lesser Slave L. district, *Brinkman*, no. 4201 (N).

**Smilacina stellata** (L.) Desf. — *Vagnera stellata* (L.) Morong.

Damp thickets near Dawson Creek, June 8, nos. 3510, 3518; top of dry river bluff at Taylor Flat, June 12, no. 3563. In flower. — Horseshoe Cr., alt. 2400 ft., *Mrs. Henry*, no. 216 (P).

**Smilacina trifolia** (L.) Desf. — *Vagnera trifolia* (L.) Morong. Lesser Slave L. district, *Brinkman*, nos. 4165, 4255 (N).

**Maianthemum canadense** Desf. var. **interius** Fern. — *Unifolium canadense* (Desf.) Greene var. *interius* (Fern.) House. — See Rhod. xvi. 211 (1914).

Rich woods along Wicked R. near the Peace R., July 18, no.

3874; upland pine woods near Hudson Hope, June 20, no. 3624. In flower. — Lesser Slave L. district, *Brinkman*, no. 4295 (N).

**Disporum trachycarpum** (Wats.) Benth.

Rich woods along Wicked R. near the Peace R., July 14, no. 3818a, and July 18, no. 3873; open woods on high bluff near Hudson Hope, June 26, no. 3601. The specimens collected in June are in flower; the later ones have immature fruits. — About 18 mi. W. of Hudson Hope, *Mrs. Henry*, no. 339 (P).

**Streptopus amplexifolius** (L.) DC.

Damp thickets on W. slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4178; rich woods along Wicked R. near the Peace R., July 14, no. 3818; rich woods along the Peace R. near mouth of Quartz Cr., July 29, no. 4214. Specimens from the mountain were in flower, those from the Wicked R. with immature fruit, and those from Quartz Cr. with ripe berries. — Lesser Slave L. district, *Brinkman*, no. 4183 (N, C).

### IRIDACEAE

**Sisyrinchium angustifolium** Miller.

Top and upper slopes of dry river bluff at Taylor Flat, June 12, no. 3555. In flower.—Wolverine Pt., *J. M. Macoun*, no. 61277, (G, N, O); Peace R. Landing, *J. M. Macoun*, no. 61278 (G, N, O); Lesser Slave L. district, *Brinkman*, no. 4548a (N); near Halfway R., N. of Bear Flats, alt. 2000 ft., *Mrs. Henry*, no. 189 (P).

### ORCHIDACEAE

**Cypripedium passerinum** Richards.

Rich spruce woods in ravine on high bluff N. W. of Hudson Hope, June 16, no. 3591, and June 27, no. 3690. In flower. — Along Halfway R., alt. about 3000 ft., *Mrs. Henry*, no. 7 (P); Musqua R., *Mrs. Henry*, no. 179 (P).

**Cypripedium parviflorum** Salisb.

McDonald R., alt. 4200 ft., *Mrs. Henry*, no. 119 (P).

**Orchis rotundifolia** Pursh.

Muskeg along Carbon R., Aug. 2, no. 4281. With immature fruit. — McLeod L., *John Macoun*, nos. 27308, 27309 (O); Lesser Slave L. district, *Brinkman*, no. 4254 (N); Musqua R., alt. 2600 ft., *Mrs. Henry*, no. 77 (P).

**Habenaria viridis** (L.) R. Br. var. **bracteata** (Willd.) Grav.

— *Coeloglossum bracteatum* (Willd.) Parl.

Thickets on high bluff near Hudson Hope, June 16, no. 3600; upland pine woods near Hudson Hope, June 20, no. 3623. In flower. — Peace R. Landing, *J. M. Macoun*, no. 61275 (O); Lesser Slave L. district, *Brinkman*, no. 4501a (N); Pink Mt., alt. 4000 ft., *Mrs. Henry*, no. 239 (P).

**Habenaria unalaschensis** Wats.

McLeod L., *John Macoun*, no. 27247 (O).

**Habenaria hyperborea** (L.) R. Br. — *Limnorchis hyperborea* (L.) Rydb.

Mossy sand bank along Wicked R. near the Peace R., July 30, no. 4234; muskeg along Carbon R., Aug. 2, no. 4291; muskeg slough near W. end of Rocky Mt. Portage, Aug. 3, no. 4333a; springy places on river bank at Hudson Hope, June 22, no. 3655. All in flower.

**Habenaria obtusata** (Pursh) Richards. — *Lysiella obtusata* (Pursh) Rydb.

Rich woods along Wicked R. near the Peace R., July 14, no. 3813; spruce woods in ravine on high bluff N. W. of Hudson Hope, June 16, no. 3594. In flower. — McLeod L., *John Macoun*, nos. 27213, 27214 (O); near Prophet R., alt. 3500 ft., *Mrs. Henry*, no. 172 (P); Musqua R., alt. 2600 ft., *Mrs. Henry*, no. 75 (P).

**Habenaria orbiculata** (Pursh) Torr. — *Lysias orbiculata* (Pursh) Rydb.

Rich woods along Wicked R. near the Peace R., July 14, no. 3832, and July 18, no. 3868; rich spruce woods near head of Rocky Mt. Canyon, July 7, no. 3740; along Rocky Mt. Portage road near W. end, rich woods, Aug. 4, no. 4346; rich woods in ravine on high bluff N. W. of Hudson Hope, June 27, no. 3691. All in flower.

**Spiranthes Romanzoffiana** Cham. — *Ibidium Romanzofianum* (Cham.) House.

Muskeg along Carbon R., Aug. 2, no. 4282; muskeg slough near W. end of Rocky Mt. Portage, Aug. 3, no. 4333. In flower. — Lesser Slave L. district, *Brinkman*, nos. 4501, 4680 (N); S. of Henry R., alt. 2700 ft., *Mrs. Henry*, no. 87 (P).

**Epipactis repens** (L.) Crantz. — *Perarium repens* Salisb.

Rich woods. Along Peace R. near mouth of Quartz Cr., July 29, no. 4207; along Wicked R. near the Peace R., July 30, no. 4233; near Carbon R. about 4 mi. above the Peace R., Aug. 2,

no. 4303; near W. end of Rocky Mt. Portage, Aug. 3, no. 4324. The specimens collected in July are in bud only; those in August are in flower. — Between Pine R. and Dunvegan, *Dawson*, no. 27128 (O); near Bear Cr., W. of Spirit R., *J. M. Macoun*, no. 61276 (O); Lesser Slave L. district, *Brinkman*, nos. 4045, 4416 (N); Falk R., alt. 2800 ft., *Mrs. Henry*, no. 121 (P); Musqua R., alt. 2600 ft., *Mrs. Henry*, no. 78 (P).

Athabaska Lake specimens of the above, and probably also those from the Peace River country outside the mountains, belong to var. *ophioides* (Fern.) A. A. Eat. (*Peramium ophioides* Rydb.).

**Epipactis decipiens** (Hook.) Ames. — *Peramium decipiens* (Hook.) Piper.

Rich woods along Wicked R. near the Peace R., July 30, no. 4232. In bud.

**Listera borealis** Morong. — *Ophrys borealis* (Morong) Rydb.

Mossy places along brook in rich spruce woods, ravine in high bluff N. W. of Hudson Hope, June 16, no. 3590. In flower. — Lesser Slave L. district, *Brinkman*, no. 4470 (N); Musqua R., alt. 2600 ft., *Mrs. Henry*, no. 79 (P).

**Listera cordata** (L.) R. Br. — *Ophrys nephrophylla* Rydb.

Damp grassy thickets on slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4194; rich woods along Wicked R. near the Peace R., July 14, no. 3819; spruce woods near Carbon R. about 4 mi. above the Peace R., Aug. 2, no. 4283. All in flower. — McLeod L., *John Macoun*, no. 27273 (O).

**Calypso bulbosa** (L.) Oakes. — *C. borealis* Salisb. — *Cytherea bulbosa* (L.) House.

Rich woods along Wicked R. near the Peace R., July 14, no. 3811. With immature fruit. — Near Musqua R., alt. 2300 ft., *Mrs. Henry*, no. 81 (P).

**Corallorrhiza trifida** Chat. — *C. Corallorrhiza* (L.) Karst.

Rich woods along Wicked R. near the Peace R., July 14, no. 3830; upland pine woods at Hudson Hope, June 20, no. 3629; rich woods in ravine on high bluff N. W. of Hudson Hope, June 16, no. 3589, and June 27, no. 3694; woods along Lynx Cr., N. E. of Hudson Hope, June 23, no. 3663. The specimens collected in June are in flower; those from the Wicked R. have immature fruit. — Upper Liard R., lat. 60°, *Dawson*, no. 27037 (O) (C.

*innata* of Macoun's Cat.); Lesser Slave L. district, *Brinkman*, nos. 4155, 4292a (N); mountain S. of Redfern L., alt. 4500 ft., *Mrs. Henry*, no. 40 (P).

**Corallorrhiza maculata** Raf. — *C. multiflora* Nutt.

Spruce-poplar woods near the head of Rocky Mt. Canyon, July 7, no. 3751. In flower.

#### SALICACEAE

**Populus tremuloides** Michx.

Valley of Wicked R. near the Peace R., July 30, no. 4225 (small tree); along Dawson Cr., June 8, no. 3501 (30-ft. tree). The Dawson Cr. specimen is in fruit; the other is sterile. — Lesser Slave L. district, *Brinkman*, no. 4123 (N); along Peace R. about 18 mi. W. of Hudson Hope, alt. 1800 ft., *Mrs. Henry*, no. 344 (P, A).

**Populus tacamahaca** Miller. — *P. balsamifera* DuRoi, not L. — See Jour. Arn. Arb. x. 55 (1929).

Flood plain along Peace R. near Taylor Flat, June 12, no. 3583 (tree about 60 ft. high); spruce woods in ravine on high bluff N. W. of Hudson Hope, June 27, no. 3698 (tall tree). No. 3583 is in fruit; the other is sterile. — Dease R., lat. 59°, *Dawson*, no. 24195 (O) (*P. balsamifera* of Macoun's Cat., at least in part); Lesser Slave L. district, *Brinkman*, no. 4122 (N); along Peace R. about 18 mi. W. of Hudson Hope, alt. 1800 ft., *Mrs. Henry*, no. 343 (P, A).

**Salix serissima** Fern.

Lesser Slave L. district, *Brinkman*, no. 4648 (C).

**Salix lasiandra** Benth.

Peace R. Landing, *J. M. Macoun*, no. 61266 (G, N); Lesser Slave L. district, *Brinkman*, nos. 4035, 4303 (C).

The following specimens collected in 1932, although outside the range of the present list, are of interest in connection with the occurrence of *S. lasiandra* in the Mackenzie basin:

Delta plain on the E. shore of L. Mamawi, Aug. 26, no. 4406; damp stony-sandy shores and beach lagoon margins, L. Athabaska, Shelter Pt., Aug. 28, no. 4448, and Sand Pt., Sept. 4, no. 4581. The delta specimens are just bursting their capsules; those from Shelter Pt. have ripe catkins clinging to the branches, while those from Sand Pt. are sterile.

The material of no. 4406, as well as that of no. 2084, collected by the writer at the same place in 1930, is referred somewhat doubtfully to this species. It appears to be intermediate between the western *S. lasiandra* and the eastern *S. serissima* Fernald. Its aments are shorter than those of typical *S. lasiandra*, but too long for typical *S. serissima*; the capsules, on the other hand, are longer than those of the former. *S. serissima* has pedicels only twice as long as the gland, while in the material at hand they are proportionately much longer. In leaf characters it simulates *S. lasiandra* in having the leaves rather long acuminate.

Discussion of this species complex in the available literature shows the confusion indicated above. Accompanying his original description of *S. serissima* (Rhod. vi. 3—8) Fernald points out its close relationship to the western plant, using mainly the following characters to distinguish it: late fruiting time (late August—October), long subulate capsules, and thick pedicels only twice as long as the gland. The last two of these have been dealt with above; and the question arises as to whether fruiting time is to be considered a good character in a region where the seasons are so "telescoped" as they are in the central Mackenzie basin. In 1930 these willows were beginning to fruit during the first week in August—late summer for the region, it is true—but the summer itself is exceedingly short, July being the only month which can be properly considered as such. It is to be expected that *S. lasiandra*, normally fruiting in late spring or early summer (June and early July) would, at this northeastern border of its range, be pushed to still later dates in its development. Other treatments follow the above characters rather closely, contributing nothing to the solution of the problem (Schneider in Jour. Arnold Arb. I. 13—20, III. 98—9; Ball, Can. Field Nat. XL. 149—50; Rydberg, Fl. Rocky Mts. and Adj. Plains, 188). It should also be noted that *S. serissima* in the east and in the Great Lakes region is a plant of "deep sphagnum bogs or larch swamps" (Fernald, l. c.), while in the northwest the plants grow on flood plains and sandy lake beaches.

**Salix interior** Rowlee var. **pedicellata** (Anders.) Ball. — *S. linearifolia* Rydb. — See Can. Field Nat. XL. 175 (1926).

Flood plain along Peace R. at Taylor Flat, June 12, no. 3587 (tall shrub). Just past flowering. — Along Peace R., lat. 56°, *John Macoun*, 1872, no. 24578 (O); upper Liard R., lat. 60°,

Dawson, no. 245181 (O); Peace R. Landing, *J. M. Macoun*, no. 61268 (N, O). The John Macoun and Dawson specimens are under *S. longifolia* in Macoun's Cat.

**Salix reticulata** L.

Damp turf and stony ground on the upper slopes of Mt. Selwyn. Summit, July 19, no. 3929; alt. 4—5000 ft., July 19, no. 3928; near small lake, July 26, no. 4128. Mostly in flower; a few in no. 3928 with bursting capsules. — Robb L., alt. 4000 ft., *Mrs. Henry*, (P); basin above Robb L., alt. 5500 ft., *Mrs. Henry*, (P).

**Salix polaris** Wahl. var. *selwynensis*, var. nov. Plate IV.

A *S. polaris* typica differt amentis longioribus ( $\varphi$  0.7—2.7 cm. longis, 0.5—1.2 cm. latis,  $\sigma$  1—2 cm. longis, 0.4—0.8 cm. latis), saepe 16—25-floris; foliis constantius ovato-ellipticis vel obovatis quam orbiculatis.

Differs from typical *S. polaris* in having longer aments ( $\varphi$  0.7—2.7 cm. long, 0.5—1.2 cm. wide;  $\sigma$  1—2 cm. long, 0.4—0.8 cm. wide) often with 16—25 flowers; and in having its leaves more constantly ovate-elliptic or obovate rather than orbiculate.

Damp turf and stony ground on the upper slopes of Mt. Selwyn. Summit, July 19, no. 3909; alt. about 6000 ft., July 13, nos. 3760, 3771, 3772; near small lake, alt. about 5000 ft., July 26, nos. 4123, 4135; alt. 4—5000 ft., July 19, no. 3932 (Type); N. W. ridge, alt. about 4000 ft., July 23, (fragment) no. 4056. Those from the summit are in flower, with old catkins still clinging; the ones collected at about 6000 ft., but earlier, are in flower and young fruit; those of July 26 have maturing capsules. — Mountain N. of St. Paul's L., alt. 6700 ft., *Mrs. Henry*, no. 134 (P); Mt. of the Gods, alt. 6000 ft., *Mrs. Henry*, no. 169 (P) mountain at head of Besa R., alt. 5500 ft., *Mrs. Henry*, (P).

This semi-herbaceous willow, with its creeping stems and thin bright green leaves is one of the primary species on the summit of Mt. Selwyn (about 7000 ft.). It is associated in the sparse flora with *Selaginella Standleyi*, *Carex nardina* var. *Hepburnii*, and a few others, but below the summit, although very common, it shares prominence with *S. reticulata*, *S. brachycarpa* var. *antimima*, *Dryas integrifolia*, and various grasses and sedges.

Typical *S. polaris* has been very little collected in America, and then only on the far northwestern coasts. In his monographic studies of American willows, Schneider gives a good dis-

cussion of the status of the species on this continent (Bot. Gaz. LXVII. 49—50), pointing out that the only specimens which he saw (Port Clarence, Alaska, *Trelease and Saunders*, nos. 3387, 3385a) seemed "to agree with specimens of S. J. Enander's Salic. Scand. Exsicc. from Spitzbergen, especially with no. 12 'modificatio foliis subovalibus'". The writer has seen the Scandinavian material as well as that from Port Clarence, and would agree with Schneider's opinion. There is, in the herbarium of the Arnold Arboretum, a photograph of the only other recorded specimen of *S. polaris* in America. This is in the Bebb Herbarium at the Field Museum, Chicago, and was collected by J. M. Macoun (no. 14) at Cape Vancouver. It clearly resembles the European material with its ovate to orbicular leaves and short aments. Apparently no form of the species has been noted in the American cordillera. John Macoun's collections of 1875 undoubtedly contained the present variety, but it was among those unfortunately lost. Schneider (l. c.) notes a specimen collected on Mt. McKinley by R. L. Shainwalt, Jr., in 1903, "which is very similar to *S. polaris* in every respect, but the fruiting aments measure up to 3 cm. in length and 9 mm. in width". He states, however, that the sessile fruits are pubescent only toward the apex, while in the writer's material they are quite pubescent over the whole surface or are very occasionally glabrous in age toward the base. He suggests that the Mt. McKinley plant might be "a new variety of *S. polaris* or a new species." The writer has seen, also, specimens collected by Mrs. J. Norman Henry in northern British Columbia (1931) which are identical with his own.

Floderus, in his studies of the Salix flora of Kamtchatka, (Arkiv för Bot. xx. no. 6, pp. 8—12, 1926) described a species, *S. pseudopolaris*, which appears to have much in common with the writer's material, but judging from the rather detailed description given (it is figured in Komarov, Fl. Penin. Kamtch. II. Pl. I.) it is not identical. It has catkins 10—15 mm. long, with "about 15 flowers"; leaves "elliptically rounded (usually broadest just above the middle) with broad base and generally shallowly emarginate at the top, . . . 3—4 pairs of lateral nerves, mainly issuing from the basal portion of the central nerve . . . under surface paler green". The var. *selwynensis* has from 4 to 8 pairs of lateral nerves in the leaves, often well-distributed over the lower two thirds of the mid-vein. Also, the leaves are more commonly

obtuse or rounded than emarginate at the apex, and are scarcely if at all paler beneath.

**Salix arctica** Pall. — See Bot. Gaz. LXVI. 118—26 (1918).

Rocky ledges, W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3964 (sprawling shrub 1—2 dm. high). In fruit.

**Salix brachycarpa** Nutt.

Muskeg along Carbon R., Aug. 2, nos. 4307, 4308 (shrub, up to 1 m. high). In fruit. — Bank of Henry R., alt. 4000 ft., *Mrs. Henry*, no. 146 (P); near Norman R., alt. 6300 ft., *Mrs. Henry*, no. 105 (P).

**Salix brachycarpa** Nutt. var. **antimima** (Schneid.) Raup. — See Rhod. XXXIII. 241—4 (1931).

Rock crevices and ledges, W. slope of Mt. Selwyn (low shrub). Alt. about 6000 ft. July 13, nos. 3762, 3763; near small lake, alt. about 5000 ft., July 26, nos. 4136, 4137. With late flowers and immature fruits. Nos. 4136 and 4137 appear to be transitional between this and *S. glauca*.

**Salix glauca** L. — See Rhod. XXXIII. 241—4 (1931).

Thickets on W. slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4173 (low shrub). In fruit.

**Salix glauca** L. var. **acutifolia** Schneid. — See Bot. Gaz. LXVI. 327 (1918); LXVII. 60 (1919).

Edge of Robb L., alt. 4200 ft., *Mrs. Henry*, no. 256 (P).

**Salix Mackenziana** Barratt.

Gravel bars and local river flood plain deposits in the upper Peace region (shrubs or small trees). Along Peace R. near the Wicked R., July 16, no. 3849; along the Peace at Taylor Flat, June 12, nos. 3585, 3588; along Dawson Cr., June 8, no. 3505. The specimens collected in June have flowers, and some fruits just beginning to mature; those from the Wicked R. have mature fruits. — Upper Liard R., lat. 60°, *Dawson*, no. 24348 (O) (not examined).

**Salix lutea** Nutt.

Peace R. Landing, *J. M. Macoun*, no. 61267 (G, N).

**Salix myrtillifolia** Anders.

Muskeg along Carbon R., Aug. 2, no. 4311 (low shrub). Sterile. — Lesser Slave L. district, *Brinkman*, no. 4269 (C).

**Salix Barclayi** Anders.

Thickets on W. slope of Mt. Selwyn, near small lake, alt. about

5000 ft., no. 4139 (shrubs about 1 m. high), and alt. about 4000 ft., July 26, no. 4166; banks of Wicked R. near the Peace R. July 16, no. 3836, July 30, no. 4227, and July 31, no. 4242 (shrubs 1—2 m. high). Specimens collected at 5000 ft. on the mountain, July 26, were near recently melting snow and are in flower; those at 4000 ft., on the same date, have maturing fruit. The Wicked R. specimens all have mature fruit. — Near Halfway R. and Cypress Cr., alt. 2500 ft., *Mrs. Henry*, no. 225 (P, A).

**Salix pseudomonticola** Ball. — See Contrib. U. S. Nat. Herb. xxii. 321 (1921); Jour. Arnold Arb. III. 73 (1921).

Slough margin along Peace R., 10 mi. above Carcajou Settlement, Aug. 15, no. 4385 (tall shrub). With old mature catkins still clinging to the branchlets.

**Salix pyrifolia** Anders. — *S. balsamifera* Barratt.

Lesser Slave L. district, *Brinkman*, no. 3934 (C).

**Salix Barrattiana** Hook.

Damp gullies and thickets on W. slope of Mt. Selwyn (shrubs up to 1 m. high). July 23, no. 4044; near small lake, alt. about 5000 ft., July 26, nos. 4138, 4140, 4141; alt. about 4000 ft., July 26, no. 4170. All in various stages of flower except the last, which is beginning to burst its capsules. Those from the higher levels are from the vicinity of recently melted snow banks, and many of them are just opening their leaf buds. — Caribou Pass, alt., 5000 ft., *Mrs. Henry*, (P).

**Salix alaxensis** (Anders.) Cov.

Damp gullies and thickets on W. slope of Mt. Selwyn (low shrub). Alt. about 5000 ft., July 13, no. 3754; July 23, no. 4045. The first is in fruit; the second is in flower and just putting forth its leaves. — Upper Liard R., lat. 60°, *Dawson*, no. 24804 (O) (not examined) (*S. speciosa* of Macoun's Cat.).

**Salix alaxensis** (Anders.) Cov. var. **longistylis** (Rydb.) Schneid. — *S. longistylis* Rydb. — See Jour. Arn. Arb. I. 225 (1920).

Gravel bars along the Wicked R. near the Peace R., July 14, no. 3804 (shrub 2—3 m. high). In mature fruit.

Study of this variety has led to some interesting comparisons of it with *S. Drummondiana* Barratt, a species which has long been an enigma among Rocky Mt. willows. This species was originally described in Hooker's Flora Boreali-Americana II. 144

(1838) from Joseph Barratt's notes, and was based upon specimens collected by Drummond in the "Rocky Mountains". Its position in the genus has long been in question. In Fl. Bor.-Am. it was placed in the Section *Cinereae*, along with *S. candida*, *S. speciosa* (*alaxensis*), *S. Scouleriana*, *S. Barrattiana*, etc.; and Andersson, in DC. Prod. xvi<sup>2</sup>. 243 (1868), put it in the *Phyllofoliae* next to *S. chlorophylla*, while he placed his *S. speciosa* var. *alaxensis* in the *Chrysanthaeae* (l. c. 275). Rydberg, in his Flora of the Rocky Mountains and Adjacent Plains, 189, places both *S. Drummondiana* and *S. alaxensis* in the same section, *Argenteae*. The most recent student of the group, Schneider, in Jour. Arn. Arb. I. 87—9 (1919), follows Andersson in his general disposition of the species, but says the following about *S. Drummondiana*: "This is apparently a rare and rather critical species. The material before me is not sufficient to understand properly its taxonomic value, and to determine clearly its relationship to the preceding group of species and to the following one." He then gives a comparison of it with *S. bella* and *S. subcoerulea* which he considered its close relatives. Schneider had before him a photograph and fragments from what has been understood as the type in the Kew Herbarium, and also he saw a co-type (two sheets) in the herbarium of the New York Botanical Garden. The present writer has had the good fortune to have, in addition to this material, a specimen found in the Barratt Herbarium at Wesleyan University, Middletown, Conn., which was labeled by Barratt himself as the type of the species. It consists of two branches, one sterile and the other with immature fruit. It is necessary here to correct an impression of this type material given by Schneider (l. c. 87). He says that the specimens show "almost an entire absence of the glaucous bloom of the branchlets . . .", whereas the New York specimens show this bloom very conspicuously. It should also be stated that many of the catkins appear to be in a state of arrested or partial development, so that some are very small (often less than 5 x 15 mm.). Rydberg, who separated *S. Drummondiana* from *S. alaxensis* on the basis of the former's small aments, was misled by the fact that all of those on the New York specimens (obviously the only ones he saw) are less than 1 cm. broad, while those on the actual type are nearly 1.5 cm. broad.

In Schneider's keys he either fails to separate the two forms or

shows a relationship between them which is not mentioned in his text. In the leaf key (Jour. Arn. Arb. III. 112) *S. Drummondiana* is not separated except by the following note which appears with *S. alaxensis*: "confer etiam speciem raram incomplete cognitam 107. *S. Drummondianam*". The key involving female aments (l. c. 106) separates these two on the basis of the woolly twigs of *S. alaxensis* contrasted with the glabrous ones of the other, but he does not mention var. *longistylis* which also has glabrous twigs, both being pruinose.

Comparison fails to bring out any morphological characters for the separation of *S. Drummondiana* and *S. alaxensis* var. *longistylis* excepting a tendency on the part of the former to have longer pedicels and shorter styles than the latter. This is evidently the reason for some authors' having placed them in different sections of the genus. However, many specimens of the latter show distinct pedicels up to 1 mm. long, while many capsules on the former are entirely sessile. In leaf and twig characters they are practically identical. The writer is inclined to look upon *Drummondiana* as an abnormal form in the *S. alaxensis* complex, but whether the abnormality is due to local physical conditions or to hybridization is too uncertain to draw any conclusions at present. If the two names are finally considered synonymous, then *S. Drummondiana*, the older name, would have to be used for the whole complex, *S. alaxensis* (typical) becoming a variety of it.

**Salix Bebbiana** Sarg. — *S. rostrata* Richards., not Thuill.

Margin of slough near W. end of Rocky Mt. Portage, Aug. 3, no. 4316 (tall shrub); thickets near Dawson Creek, June 8, nos. 3504, 3531, 3536, 3537 (shrubs 1—3 m. high). The June specimens are all in flower or very immature fruit; the later ones are in various stages of fruit. — Lesser Slave L. district, Brinkman, no. 3917 ? (C).

**Salix fallax**, sp. nov.

Plate V.

Frutex 1—1.5 m. altus; ramuli novelli subtiliter tomentosi, rubescenti-brunnei, veteres cinerei et glabri; folia obovata, integerrima, 2—7 cm. longa, 0.7—3.2 cm. lata, apice obtusa vel acuta vel rarius acuminata, basi acuta, juvenilia tenuiter sericea, adulta glabrescentia, superne viridia, subtus glauca; petioli 0.5—1.3 cm. longi, plerumque 8—10 mm. Amenta feminea 3—4 cm. longa, 1—1.2 cm. lata, pedunculo foliato 0.5—1.5 cm. longo suffulta; bractae rotundatae, fulvae, sericeo-villosae, 1 mm. longae;

capsula 4—6 mm. longa, tenuiter adpresso pubescens, pedicello gracili 1—2 mm. longo suffulta; glandula 0.6—0.8 mm. longa, lanceolata, truncata; styli 0.5—0.8 mm. longi, stigmatibus bifidis.

Shrub 1—1.5 m. high; young branchlets minutely tomentose, reddish brown, the older gray and glabrous; leaves obovate, entire, 2—7 cm. long, 0.7—3.2 cm. wide, obtuse or acute, or rarely acuminate at the apex, acute at the base, slightly silky when young, but becoming glabrous, bright green above, glaucous beneath; petioles 0.5—1.3 cm. long, mostly 8—10 mm. Female aments 3—4 cm. long, 1—1.2 cm. broad, born on leafy peduncles 0.5—1.5 cm. long; scales rounded, silky-villous, brown, about 1 mm. long; capsules 4—6 mm. long, finely appressed-pubescent; pedicels slender, 1—2 mm. long; gland 0.6—0.8 mm. long, lanceolate, truncate, stigmas divided.

Open muskeg timber along Carbon R. about 4 mi. above the Peace, Aug. 2, no. 4312. With most of the fruit mature.

As indicated in the above description this willow was collected rather late in the season, so that most of the capsules are open, and no staminate material is available at all. The habitat is a wet mossy muskeg with scattered black spruce, *Picea mariana*, and a low shrub growth of *Ledum groenlandicum*, *Salix brachycarpa*, etc. The writer is not certain of the affinities of the plant. In ament characters it appears to be related to the group of *S. pedicellaris* (placed in the Section *Roseae* by Andersson, Svensk. Vet.-Akad. Handl. vi. 96 (1867), and so maintained by Schneider, Jour. Arn. Arb. II. 81), but its larger, broader leaves with long petioles, and its more spreading habit distinguish it clearly. Some of its leaves suggest glabrous forms of *S. Bebbiana*.

**Salix pedicellaris** Pursh var. **hypoglauca** Fernald. — See Rhod. XI. 161 (1909) and Jour. Arn. Arb. II. 82 (1920).

Lesser Slave L. district, *Brinkman*, no. 4545 (C).

**Salix petiolaris** Sm.

Thickets near Dawson Creek, June 8, nos. 3503, 3532, 3534, 3539 (shrubs 2—3 m. high). In late flower and young fruit. — Lesser Slave L. district, *Brinkman*, no. 3870 (C).

**Salix planifolia** Pursh. — *S. chlorophylla* Anders. — See Jour. Arn. Arb. I. 75 (1919).

Slough margin near W. end of Rocky Mt. Portage, Aug. 3, no. 4317 (large shrub); thickets near Dawson Creek, June 8, nos.

3514, 3535, 3538 (shrubs 2—3 m. high); upland woods along road N. of Dawson Creek, June 9, no. 3542 (tall shrub). The June specimens are beginning to mature their fruit; the later ones have mature aments still clinging to the branches.

**Salix subcoerulea** Piper.

Gravel bar along Peace R. near the Wicked R., July 16, no. 3848 (tall shrub); margin of slough near Peace R. about 6 mi. below the Wicked R., July 22, no. 4039 (tall shrub); thickets along Dawson Cr., June 8, nos. 3505, 3512 (shrubs 2—3 m. high). In fruit. — Lesser Slave L. district, *Brinkman*, nos. 4115, 4349 (C).

**Salix sitchensis** Sanson.

McLeod L., *John Macoun*, no. 24797 (O) (*S. Sitchensis* var. *angustifolia* of Macoun's Cat.).

**Salix arbusculoides** Anders.

In timbered ravine on high bluff N. W. of Hudson Hope, June 27, no. 3700 (tall shrub); along brook on slope of high bluff S. of the Peace R. at Hudson Hope, June 28, no. 3714 (small tree). These have mature aments on them except for no. 3714, which is doubtfully referred to this species. Its sterile branches resemble some forms of *S. discolor*, but the latter is otherwise not known in the region. — Henry R., alt. 2300 ft., *Mrs. Henry*, no. 136 (P).

MYRICACEAE

**Myrica Gale** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

BETULACEAE

**Corylus cornuta** Marsh. — *C. rostrata* Ait.

Slope of river bluff just back of the town of Hudson Hope, June 23, no. 3676 (shrubs to 1.5 m. high). With immature fruit. — Lesser Slave L. district, *Brinkman*, nos. 4070, 4393 (N).

**Betula papyrifera** Marsh.

Dry slope of river bluff at Taylor Flat, June 12, no. 3545 (small tree). Fruit immature. — Mt. Selwyn, *John Macoun*, no. ? 23824 (O); Lesser Slave L. district, *Brinkman*, no. 3997 (C).

**Betula papyrifera** Marsh. var. **occidentalis** Sarg.

Spruce woods along Peace R. near mouth of Quartz Cr., July 29, no. 4212 (tall tree). In fruit. — Lesser Slave L. district, *Brinkman*, nos. 4475?, 4642 (C).

**Betula papyrifera** Marsh. var. **neoalaskana** (Sarg.), comb. nov. — *B. alascana* Sarg., not Lesquereux. — *B. neoalaskana* Sarg.

Bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4386 (trees 10—15 m. high). In fruit.

This variety, distinguished from the species chiefly by its resinous-glandular twigs does not seem worthy of the specific rank sometimes given to it. It is the commonest form throughout the central part of the Mackenzie basin.

**Betula microphylla** Bunge. — *B. fontinalis* Sarg.

Willow thicket on the river terrace above Hudson Hope (shrub about 2 m. high). June 16, no. 3614; June 20, no. 3621. With late flowers and very young fruits.

**Betula glandulosa** Michx.

Damp thickets on W. slope of Mt. Selwyn, alt. about 4500 ft., July 13, no. 3759 (shrubs up to 1 m. high); muskeg along Carbon R., Aug. 2, no. 4261 (low shrub). The Mt. Selwyn specimens have flowers and the remains of old fruiting aments; the others are maturing the current year's fruit. — White Mud Cr., N. of Dunvegan, *J. M. Macoun*, no. 61272 (G, N, O); mountain-top near Norman R., alt. 6300 ft., *Mrs. Henry*, no. 104 (P).

**Alnus crispa** (Ait.) Pursh. — *A. alnobetula* Amer. auth.

Damp gully on W. slope of Mt. Selwyn, alt. about 4000 ft., July 13, no. 3758 (shrubs 1—2 m. high); rich woods along Wicked R. near the Peace, July 30, nos. 4224, 4228 (shrubs 1—3 m. high); poplar woods at Hudson Hope, June 16, no. 3615 (shrubs 1—3 m. high); rich woods in ravine on high bluff N. W. of Hudson Hope, June 27, no. 3702 (shrubs 1—3 m. high); upland pine woods N. of Dawson Creek, June 9, no. 3541 (shrubs 1—3 m. high). The Dawson Creek and Mt. Selwyn specimens are in flower; those collected in June at Hudson Hope have their female aments beginning to enlarge; the others are maturing fruit. — Lesser Slave L. district, *Brinkman*, nos. 3902, 4120, 4339, 4576 (N); Notikewin Moss, 2290 (G).

Rocky Mountain specimens in this species complex are commonly determined as *A. sinuata* (Regel) Rydb., but the writer has been unable to separate them satisfactorily from the widespread *A. crispa*.

**Alnus incana** (L.) Moench.

On the bank of the Peace R. near the mouth of Quartz Cr.,

July 29, no. 4211 (shrubs 3—5 m. high); rich woods in ravine on high bluff N. W. of Hudson Hope, June 27, no. 3699 (tall shrub); With old cones and young fruiting aments. — Frances L., lat. 61°, *Dawson*, no. 20326 (O) (*A. rubra* of Macoun's Cat.); Lesser Slave L. district, *Brinkman*, nos. 4017, 4323 (N).

Western specimens in the *A. incana* group are commonly referred to *A. tenuifolia* Nutt., but as in the case of *A. crispa*, the writer is hesitant to separate those cited here from the wide-ranging form usually known as *A. incana*.

#### URTICACEAE

**Urtica gracilis** Ait. — See Rhod. xxviii. 191 (1926).

Lesser Slave L. district, *Brinkman*, nos. 4241, 4331, 4500 (N); Saddle Hills, *Moss*, no. 2388 (G). Probable representatives of this species were also observed near timber line on Mt. Selwyn.

#### SANTALACEAE

**Comandra pallida** A. DC.

Dry gravelly slope of river bluff at Taylor Flat, June 12, no. 3577. In flower. — Peace R. Landing, *J. M. Macoun*, no. 61269 (N, O).

**COMANDRA UMBELLATA** Nutt. — possibly *C. PALLIDA* A. DC.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Geocaulon lividum** (Richards.) Fern. — *Comandra livida* Richards. — See Rhod. xxx. 21 (1928).

Rich woods along Wicked R. near the Peace R., July 30, no. 4236; muskeg along Carbon R., Aug. 2, no. 4298; rich woods in ravine on high bluff N. W. of Hudson Hope, June 27, no. 3695. The June specimens have flowers and a few young fruits; the others have maturing fruit. — Frances R., lat. 61°, *Dawson*, no. 23864 (O); Lesser Slave L. district, *Brinkman*, no. 4258 (C); 18 mi. W. of Hudson Hope, alt. 1800 ft., *Mrs. Henry*, no. 337 (P).

#### LORANTHACEAE

**ARCEUTHOBIAUM AMERICANUM** Nutt. — *Razoumofskya americana* (Nutt.) Ktze.

Lesser Slave L. district, *Brinkman*, 1929.

#### POLYGONACEAE

**Rumex occidentalis** S. Wats.

Lesser Slave L. district, *Brinkman*, nos. 4507, 4552a (N).

**Rumex maritimus** L. var. **fueginus** (Phil.) Dusén. — See Rhod. xvii. 73 (1915).

Between Dunvegan and Spirit R., *J. M. Macoun*, no. 61274 (O); Lesser Slave L. district, *Brinkman*, no. 4507 (N).

**Rumex Acetosa** L.

Damp grassy meadow on W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4075. In flower and immature fruit. — Mountain-top near Norman R., alt. 6000 ft., *Mrs. Henry*, no. 88 (P).

**Oxyria digyna** (L.) Hill.

Damp mossy ledges and slopes of Mt. Selwyn. Near small lake, alt. about 5000 ft., July 26, no. 4132; alt. about 4500 ft., July 13, no. 3784; alt. about 4000 ft., July 26, no. 4084. All in flower. — Mountain N. of Redfern L., alt. 6000 ft., *Mrs. Henry*, nos. 299, 312 (P); Mt. McCusker, alt. 6000 ft., *Mrs. Henry*, no. 319 (P).

**Polygonum aviculare** L.

Lesser Slave L. district, *Brinkman*, no. 4520 (N).

**POLYGONUM TENUE** Michx. — possibly *P. DOUGLASII* Greene.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Polygonum viviparum** L. — *Bistorta vivipara* (L.) S. F. Gray.

Mossy ledges and slopes on Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3960, and July 26, no. 4082; wet mossy-sandy bank of Wicked R. near the Peace R., no. 3841. All with flowers and maturing bulblets. — Frances R., lat. 61°, *Dawson*, no. 23670 (O); Caribou Pass, alt. 5000 ft., *Mrs. Henry*, no. 325 (P); mountain-top near Norman R., alt. 6000 ft., *Mrs. Henry*, no. 94 (P).

**Polygonum lapathifolium** L. var. **salicifolium** Sibth. — *P. tomentosum* var. *incanum* (Schmidt) Gürke. — See Rhod. xxiii. 259 (1921).

Lesser Slave L. district, *Brinkman*, no. 4643 (N).

**Polygonum natans** A. Eat. — See Rhod. xxvii. 156—62 (1925).

Upland sloughs near Hudson Hope, June 27, no. 3710, and Aug. 6, no. 4336. The first is sterile; the second in flower. — Lesser Slave L. district, *Brinkman*, no. 4535 (N).

**POLYGONUM CONVOLVULUS** L. — *Bilderdykia Convolvulus* (L.) Dum.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

## CHENOPodiACEAE

**Chenopodium capitatum** (L.) Asch. — *Blitum capitatum* L.

Cabin clearing at mouth of Wicked R., July 31, no. 4256.  
With flowers and immature fruits.

**CHENOPODIUM GLAUCUM** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872;  
saline springs along Peace R. above the Smoky R., *John Macoun*,  
1875.

**Chenopodium hybridum** L.

Between Dunvegan and Spirit R., *J. M. Macoun*, no. 61273  
(O).

**Chenopodium album** L.

Dry bluff along Peace R. about 10 mi. above Carcajou Settlement,  
Aug. 15, no. 4377. With maturing fruits.

**CORISPERMUM HYSSOPIFOLIUM** L.

Saline springs along Peace R. above the Smoky R., *John Macoun*,  
1875.

**SALICORNIA HERBACEA** L. — probably *S. EUROPAEA* L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872;  
saline springs along Peace R. above the Smoky R., *John Macoun*,  
1875.

**SUAEDA MARITIMA** Dumort. — probably *S. DEPRESSA* (Pursh) Wats.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

## PORTULACACEAE

**Claytonia lanceolata** Pursh.

Mountain-top near Norman R., alt. 6000 ft., *Mrs. Henry*, no.  
90 (P).

## CARYOPHYLLACEAE

**Stellaria borealis** Bigelow. — *Alsine borealis* (Bigelow)  
Britton. — See Rhod. xvi. 144—51 (1914).

Damp thicket on bank of Wicked R. near the Peace R., July  
14, no. 3822; wet meadow near W. end of Rocky Mt. Portage,  
Aug. 3, no. 4332. With flowers and immature fruit. — McLeod L.,  
*John Macoun*, no. 714 (O) (*S. calycantha* of Macoun's Cat.).

**Stellaria crassifolia** Ehrh. — *Alsine crassifolia* (Ehrh.)  
Britton.

Lesser Slave L. district, *Brinkman*, no. 4627 (N).

**Stellaria longipes** Goldie. — *Alsine longipes* (Goldie) Cov.

Along Rocky Mt. Portage road near Hudson Hope, Aug. 6,  
no. 4338. In flower. — McLeod L., *John Macoun*, no. 720300

(O); McAllister Cr., *J. M. Macoun*, no. 59573 (G, N, O); Lesser Slave L. district, *Brinkman*, no. 4284 (N); Notikewin, *Moss*, no. 2276 (G); Mosquito Flats, 100 mi. N. W. of Ft. St. John, alt. 3000 ft., *Mrs. Henry*, no. 14 (P); Halfway R. and Cypress Cr., alt. 2500 ft., *Mrs. Henry*, no. 266 (P).

**Stellaria longipes** Goldie var. **Edwardsii** (R. Br.) Wats. — *Alsine Edwardsii* (R. Br.) Rydb.

Near small lake on W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4118. In flower.

**Stellaria longifolia** Muhl. — *Alsine longifolia* (Muhl.) Britton.

Slough near W. end of Rocky Mt. Portage, Aug. 3, no. 4318. With flowers and a few immature fruits. — Lesser Slave L. district, *Brinkman*, nos. 3978, 4678 (N).

**STELLARIA MEDIA** (L.) Cyrill.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Cerastium Beeringianum** Cham. & Schl. — See Rhod. xxii. 169 (1920).

Mossy crevices and slopes on Mt. Selwyn, alt. 4—5000 ft., July 19, nos. 3908, 3963; July 23, no. 4066b; July 26, nos. 4117, 4188. In flower.

**Cerastium vulgatum** L.

North of Finlayson L., lat. 59°, *Dawson*, no. 4610 (O).

**Cerastium nutans** Raf.

Lesser Slave L. district, *Brinkman*, no. 4497 (N); Lesser Slave L., *Moss*, no. 2227 (G).

**Cerastium arvense** L.

Grassy meadow near Dawson Creek, June 8, no. 3533. In flower. — White Mud R., N. of the Peace, *J. M. Macoun*, no. 59574 (G, N, O); head of Sukunka R., *Sheldon and Borden*.

**Arenaria lateriflora** L. — *Moehringia lateriflora* (L.) Fenzl.

Rich woods on upper slopes of bluff S. of the Peace R. at Hudson Hope, June 28, no. 3720. With flowers and maturing capsules. — Lesser Slave L. district, *Brinkman*, no. 4180 (N); near Halfway R. N. of Bear Flats, alt. 2200 ft., *Mrs. Henry*, no. 186 (P).

**Arenaria verna** L. — *Alsinopsis verna* (L.) Cockerell.

Near small lake on W. slope of Mt. Selwyn, alt. about 5000 ft. June 26, no. 4093. In flower.

**Arenaria verna** L. var. **pubescens** (Cham. & Schl.) Fern. — See Rhod. xxi. 21 (1919).

Crevices and stony ground, W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3952; on limestone slide rock, N. side of the Peace R. about 6 mi. below the Wicked R., July 22, no. 4010. In flower. — Mountain-top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 65 (P); mountain N. of Redfern L., alt. 6000 ft., *Mrs. Henry*, no. 313 (P); basin above Robb L., alt. 6000 ft., *Mrs. Henry*, nos. 264, 264a (P).

**Arenaria Rossii** Richards. — *Alsinopsis Rossii* (Richards.) Rydb.

Damp mossy ledges and crevices on Mt. Selwyn, alt. 5—6000 ft. July 13, no. 3761; July 19, no. 3951. In flower. All of these plants have dark purplish sepals, a character not found in current descriptions of the species, but noted in the original.

**Arenaria Rossii** Richards. var. **columbiana**, var. nov.  
Plate VI. 1.

Sepala purpurascens apice rotundato-obtusa vel parum mucronata.

Differs from the species in having its purplish sepals rounded-obtuse or very slightly mucronate. In the species they are sharply acute.

Pass N. of Robb L., alt. 5500 ft., *Mrs. Henry*, no. 262 (P). The type specimen is a mat 12—14 cm. in diameter, collected in flower on July 25, 1932. Mrs. Henry's note states that it was growing on "wet stones".

**Arenaria obtusiloba** (Rydb.) Fern. — *Alsinopsis obtusiloba* Rydb.

Damp crevices near small lake on W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4116. In flower.

**Silene noctiflora** L.

Lesser Slave L. district, *Brinkman*, no. 4352 (N).

**SILENE DOUGLASII** Hook.

Dease R., Dawson, 1887.

**Silene acaulis** L. var. **exscapa** (All.) DC. — See Rhod. xxiii. 119—20 (1921).

Damp ledges and crevices on slopes of Mt. Selwyn, alt. 4—6000 ft. July 13, no. 3766; July 19, no. 3937; July 23, no. 4063. In flower.

**Silene acaulis** L. var. **subacaulescens** (F. N. Williams) Fern. & St. John. — See Rhod. xxiii. 119—20 (1921).

Mountain N. of St. Paul's L., alt. 5500 ft., *Mrs. Henry*, no. 128 (P).

**Lychnis Drummondii** Wats.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Lychnis furcata** (Raf.) Fern. — See Rhod. xxxiv. 22—5 (1932).

Mountain-top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 58 (P).

**Lychnis triflora** R. Br. var. **Dawsonii** B. L. Robinson.

Dease R., lat. 59°, Dawson, (G, O).

**Lychnis attenuata** Farr.

Crevices in slide rock, N. W. and W. slopes of Mt. Selwyn, alt. about 5000 ft. July 19, no. 3906; July 23, no. 4051. In flower. — Mountain near Mt. Kenny, alt. 6200 ft., *Mrs. Henry*, no. 288 (P).

#### NYMPHAEACEAE

**Nymphaezanthus variegatus** (Engelm.) Fern. — *Nymphaea variegata* (Engelm.) G. S. Miller. — See Rhod. xxi. 187 (1919).

Although there are no definite records for this species it is probably common throughout the central plain region. The notes on *Nuphar advena* Ait. in Macoun's list of 1875, indicating a range through the Peace and Athabaska basins east of the mountains, are probably for this species. It is the common form on the lower Peace and through the great lake region of the Mackenzie basin.

**Nymphaezanthus polysepalus** (Engelm.) Fern.

McLeod L., *John Macoun*, no. 1441 (O).

#### RANUNCULACEAE

**Coptis groenlandica** (Oeder) Fern. — See Rhod. xxxi. 142 (1929).

Lesser Slave L. district, *Brinkman*, no. 4438 (N).

**Actaea rubra** (Ait.) Willd.

Rich woods along Peace R. near mouth of Quartz Cr., July 29, no. 4216; poplar thicket along Dawson Cr., June 8, no. 3509. The first is in fruit; the second in flower. — Dunvegan, *J. M. Macoun*, no. 59515 (O); Lesser Slave L. district, *Brinkman*, no. 4297 (N); near Halfway R., alt. 2500 ft., *Mrs. Henry*, no. 205 (P).

**Aquilegia brevistyla** Hook.

Hudson Hope, June 19, no. 3619; poplar woods on slope of high bluff south of the Peace at Hudson Hope, June 28, no. 3722. The

first is in flower; the second with immature fruit. — Frances R., lat.  $61^{\circ}$ , *Dawson*, no. 1304 (O); Peace R. Landing, *J. M. Macoun*, no. 59523 (O); Halfway R., alt. 3500 ft., *Mrs. Henry*, no. 15 (P); near Redfern L., alt. 4000 ft., *Mrs. Henry*, (P); Cypress Cr., alt. 2400 ft., *Mrs. Henry*, no. 228 (P).

**Aquilegia columbiana** Rydb. — See Bull. Torr. Bot. Club, xxix. 145 (1902).

Thickets on W. and N. W. slopes of Mt. Selwyn, alt. about 4000 ft., July 13, no. 3787, and July 23, no. 4062; rich woods along Wicked R., July 14, no. 3809, and July 18, no. 3872. In flower; the last with some immature fruit. — Above Robb L., alt. 4800 ft., *Mrs. Henry*, nos. 258, 268 (P); between second and third forks of Nelson R., alt. 4500 ft., *Mrs. Henry*, no. 275 (P).

**Delphinium scopulorum** Gray var. **glaucum** Gray.

Damp ledges and slopes on Mt. Selwyn. Near small lake, alt. about 5000 ft., July 26, no. 4131; in thickets, alt. about 4000 ft., July 26, no. 4176, and July 23, no. 4067. In flower. — N. of Finlayson L., lat.  $61^{\circ}$ , *Dawson*, no. 1340 (O); Lesser Slave L. district, *Brinkman*, no. 4386 (N); near Halfway R., alt. 2400 ft., *Mrs. Henry*, no. 203 (P).

**Aconitum delphinifolium** DC.

Damp ledges, thickets, and open slopes on Mt. Selwyn, alt. 3—6000 ft., July 13, nos. 3767, 3798; July 19, no. 3931; July 22, no. 4029; July 26, no. 4189; rich woods along Wicked R., July 14, no. 3825. All in flower except no. 3767 (alt. about 6000 ft.) which is in bud. — Finlayson R., lat.  $61^{\circ}$ , *Dawson*, no. 1346 (O) (*A. Napellus* var. *delphinifolium* of Macoun's Cat.); Quarter Cr., alt. 2800 ft., *Mrs. Henry*, no. 173 (P); pass near Summit L., alt. 4200 ft., *Mrs. Henry*, no. 32 (P); near Halfway R., alt. 3200 ft., *Mrs. Henry*, no. 13 (P).

**Anemone parviflora** Michx.

Damp turf slopes of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3950; crevices in slide rock along Wicked R., July 14, no. 3807a; damp sandy shore of Wicked R. near the Peace R., July 18, no. 3880; sandy bank of Peace R., and in rock crevices, at the head of Rocky Mt. Canyon, July 7, no. 3737. In flower; no. 3880 has immature fruit also. — Dease L., *Dawson*, no. 887 (O); Canyon of Liard R., lat.  $60^{\circ}$ , *Dawson*, no. 961 (O); Sikanni Chief R., alt. 4000 ft., *Mrs. Henry*, no. 28 (P); above Redfern L., alt. 5500 ft.,

*Mrs. Henry*, no. 49 (P); head of Sukunka R., *Sheldon and Borden*.

**Anemone multifida** Poir. var. **hudsoniana** DC. — See Rhod. xix. 141 (1917).

Turfy slopes of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3954; slide rock along Wicked R., July 14, no. 3807; poplar thicket at Hudson Hope, June 29, no. 3726; top of dry river bluff at Taylor Flat, June 12, nos. 3549, 3568. All with flowers, or flowers and immature fruit. The Rocky Mt. form of this species has been called *A. globosa* Nutt., usually separated on the basis of its larger flowers. But larger-flowered forms are to be found in the east as well; and in a group in which the size of the flowers is notoriously variable, the writer can see no good reason for thus distinguishing *A. globosa*. It may be of interest, however, to note that the following nos. from the above specimens show larger flowers: 3568, 3807, 3954. — Frances R., lat. 60°, *Dawson*, no. 100751 (O); Peace R. Landing, *J. M. Macoun*, no. 59516 (O); Halfway R. and Cypress Cr., alt. 2500 ft., *Mrs. Henry*, no. 227 (P); above Cameron Cr., alt. 2200 ft., *Mrs. Henry*, no. 197 (P).

**Anemone multifida** Poir. var. **hudsoniana** DC. forma **sanguinea** (Pursh) Fern. — See Rhod. xix. 141 (1917).

Poplar thicket at Hudson Hope, June 29, no. 3726a; top of dry river bluff at Taylor Flat, June 12, no. 3548. In flower; the first with immature fruit also.

**Anemone cylindrica** Gray.

Dry river bluff at Hudson Hope, June 29, no. 3729. With flowers and very young fruit.

**Anemone riparia** Fern.

Lesser Slave L. district, *Brinkman*, no. 4543 (N).

ANEMONE DELTOIDEA Hook.

Dease L., Dawson, 1887.

**Anemone Richardsonii** Hook.

Damp willow thicket near small lake on W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4130. In flower.

ANEMONE CANADENSIS L.

Lesser Slave L. district, *Brinkman*, 1928. *John Macoun* also notes this species (as *A. pennsylvanica*) between Lesser Slave L. and Hudson Hope, 1872.

**Anemone narcissiflora** L.

Pass N. of Robb L., alt. 5200 ft., *Mrs. Henry*, no. 288 (P); Caribou Pass, alt. 5200 ft., *Mrs. Henry*, no. 281 (P).

**Pulsatilla ludoviciana** (Nutt.) Heller. — *Anemone patens* L.  
var. *Wolfgangiana* (Bess.) Koch.

Grassy upper slope of dry river bluff at Taylor Flat, June 12, no. 3572. In fruit. Excellent flowering specimens have also been sent to the writer by Mr. James Ruxton from Hudson Hope in the spring of 1933. Among them are a few individuals with as many as 9 sepals. All of the floras dealing with adjacent regions give 7 as the largest number, and with one exception none of the specimens in the Gray Herbarium nor in the writer's own collections have more than 6. The exception is no. 1371, *Butters & Rosen-dahl*, Banff, Alta., June 12, 1906, which has 8 sepals on part of the plants. Further collections from the northern Rockies may show a distinct tendency toward larger numbers in that region, as suggested by these specimens.

**Clematis verticillaris** DC. var. **columbiana** Gray. —  
*Atragene columbiana* Nutt.

Thickets on quartz ridge, N. W. slope of Mt. Selwyn, alt. 3—4000 ft., July 23, no. 4068; rich woods along Wicked R. near the Peace R., July 16, no. 3842; thicket in cabin clearing at N. base of Mt. Selwyn, July 22, no. 4040; rich woods at base of Mt. Selwyn near the mouth of Quartz Cr., July 21, no. 3994; rich woods on S. slope of Peace R. valley at Hudson Hope, June 21, no. 3641. All are in various stages of fruit except the first, which is in flower.

**Ranunculus aquatilis** L. var. **capillaceus** DC.

Lesser Slave L. district, *Brinkman*, nos. 3887 (C), 4658 (N); near Lesser Slave L., *Moss*, no. 2223 (G); near S. fork of the Nelson R., alt. 4500 ft., *Mrs. Henry*, no. 161 (P).

The specimens cited probably include more than one entity, but until further work has been done upon this difficult group it is thought best to leave them as above.

**Ranunculus Purshii** Richards.

Slough margin near W. end of Rocky Mt. Portage, Aug. 3, no. 4328; dry slough along Dawson Cr., June 8, no. 3515. The first has flowers and immature fruit; the second, flowers. — Near Peace R. Landing, *J. M. Macoun*, no. 59521 (O); Lesser Slave L. district, *Brinkman*, no. 4299 (N); near Grimshaw, *Moss*, no. 2251 (G).

**Ranunculus reptans** L.

Lesser Slave L., *Moss*, no. 2231 (G); edge of lake W. of St. Paul's L., alt. 4200 ft., *Mrs. Henry*, no. 140 (P).

**Ranunculus pygmaeus** Wahl.

Damp turf slopes near small lake, W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4121; mossy ledge on N. W. shoulder of Mt. Selwyn, alt. about 4500 ft., July 23, no. 4050. In flower; the first with immature fruit also.

**Ranunculus lapponicus** L.

McLeod L., *John Macoun*, no. 1097 (O); Lesser Slave L. district, *Brinkman*, no. 4252 (N).

**Ranunculus Eschscholtzii** Schlecht.

Damp mossy slopes and ledges, W. slopes of Mt. Selwyn, alt. 4—5000 ft. July 13, no. 3785; July 19, no. 3979; near small lake, July 26, no. 4120. In flower; and the last with immature fruit.

**Ranunculus pedatifidus** J. E. Sm. var. **cardiophyllus** (Hook.) Britton. — *R. cardiophyllus* Hook.

Grazed meadows near Dawson Creek, June 8, nos. 3507, 3540. In flower.

**Ranunculus rhomboideus** Goldie.

Semi-open prairie N. of Hudson Hope, June 23, no. 3674; grazed meadows near Dawson Creek, June 8, no. 3508. With a few flowers, but mostly with maturing fruit.

**Ranunculus abortivus** L.

Rich lowland woods south of Peace R. at Hudson Hope, June 20, no. 3639. With flowers and maturing fruit. — Lesser Slave L. district, *Brinkman*, no. 4129 (N).

**Ranunculus sceleratus** L.

Slough along Peace R. about 6 mi. below the Wicked R., July 22, no. 4014; along small creek, high on S. slope of Peace R. valley at Hudson Hope, June 28, no. 3718; slough along Peace R. about 10 mi. above Carcassou Settlement, Aug. 15, no. 4352. The June specimens are in flower; the later ones have flowers and maturing fruits. — Lesser Slave L. district, *Brinkman*, no. 3927 (N).

**Ranunculus occidentalis** Nutt.

Robb L., alt. 4200 ft., *Mrs. Henry*, no. 254 (P).

**Ranunculus Macounii** Britton.

Slough along Peace R., about 6 mi. below the Wicked R., July 22, no. 4013; low ground at base of high bluff, N. of Hudson Hope, June 23, no. 3668. With both flowers and maturing fruits. — Peace R. Landing, *J. M. Macoun*, no. 59520 (O).

**Ranunculus Cymbalaria** Pursh. — *Halerpestes Cymbalaria* (Pursh) Greene.

Peace R. Landing, *J. M. Macoun*, no. 59522 (O); near sulfur springs, Toad R., alt. 4200 ft., *Mrs. Henry*, no. 110 (P).

**Thalictrum alpinum** L.

Besa R., alt. 4000 ft., *Mrs. Henry*, no. 82 (P).

**Thalictrum sparsiflorum** Turcz.

Lesser Slave L. district, *Brinkman*, no. 4168 (N); Howard R., alt. 2500 ft., *Mrs. Henry*, no. 89 (P).

**Thalictrum occidentale** Gray.

Thickets and turf ledges, W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3942, and July 26, no. 4180; open woods and rich thickets along Wicked R., July 14, no. 3827, and July 18, no. 3867; poplar woods at Hudson Hope, June 16, no. 3607; rich lowland woods S. of Peace R. at Hudson Hope, July 21, no. 3642. Those collected in June and high on Mt. Selwyn July 19 are in flower; the others have fruit in various stages of development. — Lesser Slave L. district, *Brinkman*, nos. 4329, 4329a (N); head of Sukunka R., *Sheldon and Borden*.

**Thalictrum venulosum** Trel.

Top of dry river bluff at Taylor Flat, June 12, no. 3557. In flower. — McLeod L., *John Macoun*, no. 859 ? (O); Burnt R., N. of Peace R., *J. M. Macoun*, no. 59524 (G, N); Halfway R. near Horseshoe Cr., alt. 2300 ft., *Mrs. Henry*, no. 218 (P).

**Caltha palustris** L.

Near Peace R. Landing, *J. M. Macoun*, no. 59517 (N, O).

**Caltha leptosepala** DC.

Basin above Robb L., alt. 6200 ft., *Mrs. Henry*, no. 270 (P).

**Caltha natans** Pall.

Near Peace R. Landing, *J. M. Macoun*, no. 59518 (G, O); Lesser Slave L. district, *Brinkman*, nos. 3886, 4346 (N).

### PAPAVERACEAE

**Papaver radicatum** Rottb.

Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 57 (P).

**Corydalis pauciflora** Pers.

Caribou Pass, alt. 5500 ft., *Mrs. Henry*, no. 514 (P) (1933).

**Corydalis sempervirens** (L.) Pers. — *Capnoides sempervirens* (L.) Borkh.

Lesser Slave L. district, *Brinkman*, no. 4436 (N); 100 mi. N. W. of Ft. St. John, *Mrs. Henry*, no. 1 (P).

**Corydalis aurea** Willd.

Lesser Slave L. district, *Brinkman*, no. 4114a (N); 100 mi. N. W. of Ft. St. John, alt. 2500 ft., *Mrs. Henry*, no. 8 (P).

CRUCIFERAE

**Draba alpina** L.

Mossy ledges, W. slope of Mt. Selwyn, alt. 5—6000 ft., July 19, no. 3970. With a few remnants of flowers, but with pods nearly mature. — Mt. of the Gods near Prophet R., alt. 6000 ft., *Mrs. Henry*, no. 167 (P); summit of mountain N. of St. Paul's L., alt. 6700 ft., *Mrs. Henry*, no. 132 (P); mountain above Redfern L., alt. 6000 ft., *Mrs. Henry*, no. 294 (P); same, alt. 5500 ft., *Mrs. Henry*, no. 300a (P); mountain above Robb L., alt. 5500 ft., *Mrs. Henry*, no. 268 (P).

**Draba incerta** Payson.

Damp turf ledges on W. slope of Mt. Selwyn, alt. 4—6000 ft. July 19, nos. 3913, 3917; near small lake, July 26, no. 4106. In various stages, from flower to maturing fruit. — Basin above Robb L., alt. 6000 ft., *Mrs. Henry*, no. 257 (P); mountain near Mt. Kenny, alt. 6000 ft., *Mrs. Henry*, no. 287 (P).

**Draba aurea** Vahl.

Halfway R., alt. 3500 ft., *Mrs. Henry*, no. 11 (P).

**Draba lonchocarpa** Rydb.

Damp ledges, W. slope of Mt. Selwyn, alt. 4—5000 ft. July 19, nos. 3968, 3978; near small lake, July 26, no. 4105. All with maturing pods; the last with flowers also. — Top of Mt. McCusker, alt. 6000 ft., *Mrs. Henry*, (P); mountain above Redfern L., alt. 6000 ft., *Mrs. Henry*, (P); same, alt. 5000 ft., *Mrs. Henry*, no. 304 (P); basin above Robb L., alt. 6000 ft., *Mrs. Henry*, (P).

**Draba fladnizensis** Wulf.

Damp ledges, W. slope of Mt. Selwyn, alt. 4—5000 ft. July 19, no. 3981; July 26, nos. 4100, 4107. With flowers and immature pods. No. 4100 is referred here doubtfully. — Mountain N. of Redfern L., alt. 5500 ft., *Mrs. Henry*, nos. 300, 301 (P); basin above Robb L., alt. 6000 ft., *Mrs. Henry*, no. 260 ? (P).

**Draba borealis** DC.

Damp turf ledges, W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, nos. 3914, 3915; July 26, nos. 4159, 4186; near small

lake, July 26, no. 4104; foot of slide rock along Wicked R., July 14, no. 3823. In various stages of development, from flower to maturing fruit.

**Draba longipes**, sp. nov.

Plate VI. 2.

Planta perennis; caudex laxe ramosus, basibus foliorum paucorum marcescentibus vestitus. Caules simplices, 1—1.5 dm. longi, pilis simplicibus vel ramosis tenuiter hirsuti, 1—2-phyllo, folio inferiore plerumque basi proxima. Folia oblanceolata vel obovato-oblanceolata, obtusa vel acuta, integerrima vel apicem versus 1—3-denticulata, ad 2.5 cm. longa, et ad 9 mm. lata, caulinia sessilia, basalia in petiolum latiusculum angustata, tenuiter stellato-pubescentia, ciliata, adulta superne glabra; folia ramorum juvenilium caudiculorum anguste oblanceolata. Inflorescentia florifera subcorymbosa, dein 4—6 cm. longa, 8—15-flora; pedicelli inferiores floriferi 7—11 mm. longi, fructiferi 15 mm. longi. Petala obovato-cuneata, alba vel basi flavescentia, 5—6 mm. longa, 2—2.3 mm. lata, emarginata; sepala 3 mm. longa, ovata, obtusa, glabra vel tenuiter adpresso pilosa. Siliquae 11—13 mm. longae, 2—3 mm. latae, anguste ovatae ad oblongae, glabrae; semina 16—25; styli 0.6—0.8 mm. longi.

Perennial with a loosely branched caudex bearing a few marcescent leaf-bases. Stems simple, 1—1.5 dm. high, thinly hirsute with simple or branched hairs, and with one or two leaves, the lower leaf usually near the base. Leaves oblanceolate or obovate-oblanceolate, obtuse or acute, entire or 1—3-denticulate toward the apex, reaching 2.5 cm. in length and 9 mm. in width, those of the stem sessile, the basal ones narrowed to winged petioles, thinly stellate-pubescent, ciliate, the older ones glabrous above; leaves of the young branches of the caudex narrowly oblanceolate. Inflorescence subcorymbose in flower, later becoming 4—6 cm. long, 8—15-flowered; lower pedicels of the flowers 7—11 mm. long, those of the fruits 15 mm. long. Petals obovate-cuneate, white or cream-colored at the base, 5—6 mm. long, 2—2.3 mm. wide, emarginate; sepals 3 mm. long, ovate, obtuse, glabrous or thinly appressed-pilose. Siliques 11—13 mm. long, 2—3 mm. wide, narrowly ovate or oblong, glabrous; seeds 16—25; style 0.6—0.8 mm. long.

Damp ledges and crevices, W. slope of Mt. Selwyn, near small lake, alt. about 5000 ft., July 26, nos. 4115, 4122 (Type).—Basin above Robb L., alt. 6000 ft., Mrs. Henry, no. 265 ? (P); mountain

above Redfern L., alt. 6000 ft., *Mrs. Henry*, no. 294a (P). Both of the Henry specimens are too young for definite determination.

Among American species of *Draba* this seems to be nearest *D. borealis* DC., but it is clearly distinguished from the latter and its relatives by the elongated lower pedicels of the flowers and fruits. The habit of the plants and the form of the flowering racemes strongly suggest the Asiatic *D. sachalinensis* Fr. Schmidt., but it differs from this species in having somewhat smaller flowers and much shorter styles.

**Draba stylaris** J. Gay.

Turfy ledges on W. slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4161. With flowers and immature fruit.

**Draba cinerea** Adams. — See Svensk Botanisk Tidskrift, xxiv. 483—6 (1929).

Crevices and ledges on Mt. Selwyn, alt. 4—6000 ft., July 13 no. 3777, and July 19, nos. 3971, 3982; limestone slide rock along Peace R. about 6 mi. below the Wicked R., July 22, no. 4009. The Mt. Selwyn specimens are with flowers and immature fruit; no. 4009 has mature fruit.

**Draba nemorosa** L.

Meadows near Dawson Creek, June 8, no. 3519. In flower and immature fruit. — N. of Dunvegan, *J. M. Macoun*, no. 59559 (N, O).

**Lesquerella Purshii** (Wats.) Fern. — *L. arctica* (Richards.) Wats. var. *Purshii* Wats. — See Rhod. xxxv. 267 (1933).

Henry R., ca. Aug. 18, 1931, *Mrs. Henry* (P). Hitherto considered as endemic in the Gulf of St. Lawrence region (W. Newfoundland and Anticosti I.).

**Lepidium apetalum** Willd.

Spirit R., *J. M. Macoun*, no. 59556 (N, O).

**Capsella Bursa-pastoris** (L.) Medic. — *Bursa Bursa-pastoris* (L.) Britton.

Grazed meadows near Dawson Creek, June 8, no. 3527. In flower and immature fruit.

**Brassica juncea** (L.) Cosson.

S. of Taylor Flat, *Moss*, no. 2371 (G).

**Descurainia Richardsonii** (Sweet) O. E. Schulz.

Near Halfway R., alt. 1800 ft., *Mrs. Henry*, no. 184 (P); Halfway R., near Horseshoe Cr., alt. 2300 ft., *Mrs. Henry*, no. 219 ? (rosette only) (P).

**Braya Henryae**, sp. nov.

Plate VII. 1.

Planta caespitosa, ex radice palare longe descendens. Caules 6—10 cm. altae, 1 mm. crassae, tenuiter pilis bifurcatis pubescentes, scaposae. Folia angustate spathulata, ad petiolum sensim angustata, apice rotundata vel obtusa, glabra, margine pilis simplicibus vel bifurcatis ciliata. Inflorescentia florifera capitata, fructifera 2—5 cm. longa. Sepala 3—3.5 mm. longa, ovata, obtusa, glabra vel tenuiter pilosa; petala 5 mm. longa, apice rotundata, obovato-cuneata, alba, basi purpurascens. Siliquae 8—12 mm. longae, lanceolatae, 1—2 mm. basi crassae, pilis simplicibus vel bifurcatis pubescentes; pedicelli fructiferi 2—3 mm. longi; styli 1—1.6 mm. longi, lineares, lobis stigmatum divergentibus; semina ca. 10.

Plant caespitose, from a deep tap root. Stems 6—10 cm. high, 1 mm. thick, loosely pubescent with 2-branched hairs, scapose. Leaves narrowly spatulate, gradually narrowed to petioles, rounded or obtuse at the apex, glabrous, ciliate on the margins with simple or branched hairs. Inflorescence capitate in flower, 2—5 cm. long in fruit. Sepals 3—3.5 mm. long, ovate, obtuse, glabrous or with a few scattered hairs; petals 5 mm. long, rounded at the apex, obovate-cuneate, white, purplish at the base. Siliques 8—12 mm. long, lanceolate, 1—2 mm. thick at the base, pubescent with simple or branched hairs, in fruit on pedicels 2—3 mm. long; style 1—1.6 mm. long, linear, the lobes of the stigmas spreading; seeds about 10.

Stony bank, alt. 5800 ft., pass N. of Robb L., *Mrs. Henry*, Aug. 26, 1932 (P).

The species shows obvious relationships with *B. purpurascens* (R. Br.) Bunge, and with *B. americana*. It differs from these, however, chiefly in its long pods, which are conspicuously thickened at the base, and in its long styles.

**Braya americana** (Hook.) Fern. — See Rhod. XXVIII. 203—4 (1926).

Redfern Valley, alt. 5000 ft., *Mrs. Henry*, no. 305 (P).

**ERYSIMUM CHEIRANTHOIDES** L. — *Cheirinia cheiranthoides* (L.) Link.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872; McLeod L., *Dawson*, 1879.

**Erysimum parviflorum** Nutt.

Top of high bluff N. of Hudson Hope, June 23, no. 3667; dry bluff along Dawson Cr., June 8, no. 3520. Both have flowers and

the first has also immature pods. — Peace R. Landing, *J. M. Macoun*, no. 59557 (O).

**Rorippa palustris** (L.) Bess. var. **glabrata** (Lunell) Victorin. — See Jour. Bot. XLII. 225 (1924) and Contrib. Lab. Bot. Univ. Montreal, no. 17 (1930).

Slough along Peace R. about 6 mi. below the Wicked R., July 22, no. 4015; wet meadow near W. end of Rocky Mt. Portage, Aug. 3, no. 4322. With flowers and immature fruit. — Lesser Slave L. district, *Brinkman*, no. 4563 (N).

**Barbarea orthoceras** Ledeb. — See Rhod. XI. 134—41 (1909).

Finlayson R., lat. 61°, *Dawson*, no. 1635 (O).

**Cardamine pratensis** L. var. **palustris** Wimm. & Grab. — See Rhod. XXII. 9—11 (1920).

Frances R., lat. 61°, *Dawson*, no. 1813 (O); Finlayson R., lat. 61°, *Dawson*, no. 100759 (O).

**Cardamine parviflora** L. var. **arenicola** (Britton) O. E. Schulz.

Notikewin, *Moss*, no. 2278 (G).

**Cardamine umbellata** Greene.

Caribou Pass, alt. 5000 ft., *Mrs. Henry*, no. 326 (P).

**Cardamine pensylvanica** Muhl.

Alder thicket in a flood plain slough along Peace R. about 6 mi. below the Wicked R., July 22, no. 4017. With flowers and nearly mature fruit. — North of Finlayson L., lat. 61°, *Dawson*, no. 1782 (O); N. of Dunvegan, *J. M. Macoun*, no. 59560 (N); Lesser Slave L. district, *Brinkman*, nos. 3998, 4489, 4301 (N); near Grimshaw, *Moss*, no. 2253 (G); bank of Halfway R., alt. 2400 ft., *Mrs. Henry*, no. 223 (P).

**Arabis lyrata** L. var. **occidentalis** Wats.

Damp ledges and crevices on W. slope of Mt. Selwyn, near small lake, alt. 5000 ft., July 26, no. 4096; alt. about 4000 ft., July 13, no. 3797, and July 26, no. 4153. Gravelly shore of Carbon R. about 4 mi. above the Peace R., Aug. 2, no. 4267. All with flowers and immature fruits.

**Arabis glabra** (L.) Bernh.

Along road at base of river bluff, Taylor Flat, June 12, no. 3561. With flowers and immature pods. — Halfway R. and

Horseshoe Cr., alt. 2300 ft., *Mrs. Henry*, no. 222 ? (rosette only) (P).

**Arabis hirsuta** (L.) Scop.

Poplar woods along S. side of Peace R. at Hudson Hope, June 21, no. 3638; dry river bluff at Taylor Flat, June 12, no. 3581. With flowers and immature fruit.

**Arabis retrofracta** Grah. — *A. Holboellii* of some Amer. auth.

Damp turfyle ledge on W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3958; dry slope of river bluff at Taylor Flat, June 12, no. 3573. With flowers and immature fruit, the latter with pods nearly ripe.

**Arabis Drummondii** Gray.

Damp turfyle ledge, W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4081. Mostly in flower. — Near Halfway R., alt. 2500 ft., *Mrs. Henry*, no. 224 (P).

SARRACENIACEAE

**SARRACENIA PURPUREA** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

DROSERACEAE

**Drosera rotundifolia** L.

Muskeg along Carbon R., Aug. 2, no. 4271. Beginning to flower.

CRASSULACEAE

**Sedum stenopetalum** Pursh.

Stony slopes and crevices on Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3947; July 22, no. 4028. In flower. — Pass N. of Robb L., alt. 4800 ft., *Mrs. Henry*, no. 278 (P).

SEDM RHODIOLA DC. —?

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

SAXIFRAGACEAE

**SAXIFRAGA RIVULARIS** L.

Base of Mt. Selwyn, *John Macoun*, 1875.

**Saxifraga cernua** L.

Wet mossy ledges and crevices on Mt. Selwyn, alt. 4—6000 ft., July 13, no. 3776; near small lake, July 26, no. 4112; in thicket, July 26, no. 4183. Mostly with flowers and bulblets. — Mountain-top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 60 (P).

**Saxifraga adscendens** L. — *Muscaria adscendens* (L.) Small.

Damp ledges, W. slope of Mt. Selwyn, near small lake, alt. about 5000 ft., July 26, no. 4113. In flower. — Mountain near Redfern Valley, alt. 5500 ft., *Mrs. Henry*, no. 307 (P); mountain above Robb L., alt. 5500 ft., *Mrs. Henry*, no. 267 (P); basin above Robb L., alt. 6000 ft., *Mrs. Henry*, (P).

**Saxifraga caespitosa** L. — *Muscaria caespitosa* (L.) Haw.

Damp mossy ledges and slopes on Mt. Selwyn, alt. 5—7000 ft. Summit, July 19, no. 3973; about 6000 ft., July 13, nos. 3790, 3756; near small lake, July 26, no. 4110. In flower.

**SAXIFRAGA AIZOON** Jacq. — *Chondrosea Aizoon* (Jacq.) Haw.

Base of Mt. Selwyn, *John Macoun*, 1875.

**Saxifraga ferruginea** Graham. — *Spatularia ferruginea* (Graham) Small.

Head of Sukunka R., *Sheldon and Borden*.

**Saxifraga nivalis** L. — *Micranthes nivalis* (L.) Small.

Frances R., lat. 61°, *Dawson*, no. 8379 (O); Mt. of the Gods, near Prophet R., alt. 5500 ft., *Mrs. Henry*, no. 165 (P).

**Saxifraga Lyallii** Engler. — *Micranthes Lyallii* (Engler) Small.

Damp turf slopes of Mt. Selwyn, alt. 4—5000 ft. July 13, no. 3786; July 26, near small lake, no. 4114a, and alt. about 4500 ft., no. 4152. In flower; the last with fruiting follicles beginning to form.

**Saxifraga Marshallii** Greene. — *Micranthes Marshallii* (Greene) Small.

Damp turf ledges, W. slope of Mt. Selwyn, July 19, alt. 4—5000 ft., no. 3945. In flower. — Chandlee R., alt. 2800 ft. *Mrs. Henry*, no. 102 (P); above Robb L., alt. 5500 ft., *Mrs. Henry*, no. 259 (P).

**Saxifraga Nelsoniana** D. Don. — *Micranthes Nelsoniana* (D. Don.) Small.

Damp turf ledges, near small lake on W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4114. In late flower and immature fruit.

**Saxifraga aizoides** L. — *Leptasea aizoides* (L.) Haw.

Wet ledges on W. slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4072; wet mossy place on sandy bank of Wicked R. near the Peace R., July 20, no. 3989. In flower. — Mountain N. of St. Paul's L., alt. 5500 ft., *Mrs. Henry*, no. 126 (P).

**Saxifraga tricuspidata** Rottb. — *Leptasea tricuspidata* (Rottb.) Haw.

Rocky woods along Wicked R. near the Peace R., July 18, no. 3870; limestone rock slide along Peace R. about 6 mi. below the Wicked R., June 22, no. 4012. In flower. Number 4012 has many of its leaves entirely without lateral teeth, or with only one tooth, the usual tricuspidate appearance being rare. In this it seems intermediate between *S. tricuspidata* and *S. austromontana* Wieg. — Mountain-top near Norman R., alt. 6000 ft., *Mrs. Henry*, no. 91 (P); mountain N. of St. Paul's L., alt. 5500 ft., *Mrs. Henry*, no. 130 (P); Halfway R., alt. 4300 ft., *Mrs. Henry*, no. 245 (P); pass N. E. of Robb L., alt. 5800 ft., *Mrs. Henry*, no. 276 (P).

**Saxifraga flagellaris** Willd. — *Leptasea flagellaris* (Willd.) Small.

Caribou Range, alt. 6000 ft., *Mrs. Henry*, no. 62 (P).

**Saxifraga oppositifolia** L. — *Antiphylla oppositifolia* (L.) Fourr.

Damp turf slopes of Mt. Selwyn, alt. 4500—6500 ft. About 500 ft. below summit, July 19, no. 3905; about 6000 ft., July 13, no. 3775; near small lake, July 26, no. 4103; about 4500 ft. on N. W. ridge, July 23, no. 4052. The first two with flowers and immature follicles; the last two in flower only. — Mountain N. of Redfern L., alt. 6000 ft., *Mrs. Henry*, no. 293 (P).

**Tiarella unifoliata** Hook.

Rich woods at N. W. base of Mt. Selwyn, near mouth of Quartz Cr., July 21, no. 3997. With flowers and maturing fruits.

**Heuchera Richardsonii** R. Br. — See Rhod. xxxv. 111—119 (1933).

Top of dry river bluff at Taylor Flat, June 12, nos. 3554, 3579. In flower. — Dunvegan, *Dawson*, no. 34837 (O); Peace R. Landing, *J. M. Macoun*, no. 59863 (O); Ft. St. John, *Moss*, no. 2350 (G).

**Mitella nuda** L.

Rich mossy woods. Along Wicked R. near the Peace R., July 14, no. 3816; ravine in high bluff N. W. of Hudson Hope, June 16, no. 3595. In flower. — Racing R., alt. 4200 ft., *Mrs. Henry*, no. 122 (P).

**Mitella pentandra** Hook. — *Pectianthia pentandra* (Hook.) Rydb.

Damp turf slopes on Mt. Selwyn, alt. 4—5000 ft. July 19, no. 3941; July 26, nos. 4074, 4169. In flower. Number 4169 has maturing fruit also. — McLeod L., *John Macoun*, no. 8492 (O).

**TELLIMA GRANDIFLORA** (Pursh) Dougl.

Misinchinca R., *Dawson*, 1879.

**Chrysosplenium tetrandrum** Th. Fries.

Dease R., lat. 59°, *Dawson*, no. 8538 (O); between Lesser Slave L. and Peace R. Landing, *J. M. Macoun*, no. 59862 (G, N, O); Lesser Slave L. district, *Brinkman*, no. 4149 (N).

**Parnassia fimbriata** König.

Wet slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4083; damp sandy bank of Wicked R. near the Peace R., July 30, no. 4237; muskeg along Carbon R., Aug. 2, no. 4284. In flower.

**Parnassia multiseta** (Ledeb.) Fernald. — *P. palustris* of auth. — See Rhod. xxviii. 211 (1926).

Keeley Cr., alt. 4000 ft., *Mrs. Henry*, no. 55 (P).

**Parnassia montanensis** Fern. & Rydb.

Muskeg along Carbon R., Aug. 2, no. 4284a; gravelly shore of Carbon R. about 4 mi. above the Peace R., Aug. 2, no. 4266; margin of muskeg slough near W. end of Rocky Mt. Portage, Aug. 3, no. 4326. In flower; the first two with immature fruit.

**Parnassia Kotzebuei** Cham. & Schl.

Damp gravelly slopes and ledges, W. slope of Mt. Selwyn, near small lake, alt. about 5000 ft., July 26, no. 4094; rich woods along Wicked R. near the Peace, July 14, no. 3814. In flower; the first with immature fruit.

**Ribes oxyacanthoides** L. — *Grossularia oxyacanthoides* (L.) Mill.

Thickets near Dawson Creek, June 8, nos. 3513, 3517. With flowers and very young berries. — Between Lesser Slave L. and Peace R. Landing, *J. M. Macoun*, no. 59865 (G, N, O); Lesser Slave L. district, *Brinkman*, nos. 4135, 4443, 4671 (N); Toad R., alt. 4200 ft., *Mrs. Henry*, no. 113 (P).

**Ribes hudsonianum** Richards.

At foot of limestone rock slide along Peace R. about 6 mi. below the Wicked R., July 22, no. 4016; springy place in ravine of Lynx Cr., N. E. of Hudson Hope, June 23, no. 3662; margin of slough along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4354. The June specimens have very young berries;

the others are in fruit. — Lesser Slave L. district, *Brinkman*, nos. 4131a, 4163, 4332, 4464 (N).

**Ribes laxiflorum** Pursh.

Rich woods along Wicked R. near the Peace R., July 14, no. 3802. With young berries. — Dease L., *Dawson*, no. 8620 (O).

**Ribes lacustre** (Pers.) Poir. — *Limnobotrya lacustris* (Pers.) Rydb.

Rich woods along Peace R. near mouth of Quartz Cr., July 21, no. 3992; rich spruce woods near upper end of Rocky Mt. Canyon, July 7, no. 3745. With immature fruit. — Lesser Slave L. district, *Brinkman*, nos. 4147, 4182, 4431 (N); Saddle Hills, *Moss*, no. 2390 (G).

**Ribes glandulosum** Grauer. — *R. prostratum* L'Hér.

Between Lesser Slave L. and Peace R. Landing, *J. M. Macoun*, no. 59864 (N, O); Lesser Slave L. district, *Brinkman*, nos. 4127, 4133, 4240, 4388 (N), 4439 (C).

**Ribes triste** Pall.

Rich woods along Wicked R. near the Peace R., July 14, no. 3802a; rich spruce woods in ravine on high bluff N. W. of Hudson Hope, June 16, no. 3599, and June 27, no. 3701. The June specimens have young fruit and a few flowers; the later ones are in fruit. — Dease L., *Dawson*, no. 8683 (O); Lesser Slave L. district, *Brinkman*, no. 4132 (N); near Chandler R., alt. 2800 ft., *Mrs. Henry*, no. 106 (P).

ROSACEAE

**Spiraea lucida** Dougl.

Woods at N. W. base of Mt. Selwyn, near mouth of Quartz Cr., July 21, no. 4000; roadsides near Hudson Hope, June 23, no. 3661, and June 27, no. 3687. In flower. — Northwest of Ft. St. John, *Moss*, no. 2361 (G); near Beaverlodge, *Moss*, no. 2305 (G); Peace R. near Aylard Cr., alt. 2200 ft., *Mrs. Henry*, no. 334 (P).

**Aruncus acuminatus** (Dougl.) Rydb. — See N. Amer. Fl. xxii. 255—6 (1908).

Near base of N. W. slope of Mt. Selwyn, alt. about 2500 ft., in woods, June 26, no. 4069; moist gully near upper end of Rocky Mt. Canyon, July 7, no. 3744. The first in full flower; the second with inflorescences dried up.

**Sorbus sitchensis** Roem.

Thickets on W. slope of Mt. Selwyn, alt. about 4000 ft., July

23, no. 4043, and July 26, no. 4070. Shrubs 2—4 m. high; in flower or immature fruit. — Lesser Slave L. district, *John Macoun* no. 8213 (O), and *Brinkman*, no. 4395 (C); Graham R., alt. 4500 ft., *Mrs. Henry*, no. 327 (P). The Macoun specimen is cited under *Pirus sambucifolia* in Macoun's Cat.

**Sorbus dumosa** Greene.

Spruce-poplar woods near upper end of Rocky Mt. Canyon, July 7, no. 3750. With immature fruit.

**Amelanchier florida** Lindl. — See Rhod. xiv. 117 (1912).

Rich woods along Wicked R. near the Peace R., July 30, no. 4230; upland woods at Hudson Hope, June 20, no. 3625; thickets near Dawson Creek, June 8, nos. 3500, 3502, 3530; dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4384. The June specimens are in flower; the later ones are all in various stages of fruiting. — Dease R., lat. 59°, *Dawson*, no. 8282 (O); Toad R., alt. 4200 ft., *Mrs. Henry*, no. 116 (P).

**Crataegus rivularis** Nutt. — probably *C. Douglasii* Lindl.

McLeod L., *John Macoun*, 1875. Macoun records *C. Douglasii* at Hudson Hope, 1875.

**Rubus idaeus** L. var. **canadensis** Richards. — See Rhod. xxii. 89 (1919).

Rich woods along Wicked R. near the Peace R., July 18, no. 3889; dry gravelly slope of river bluff at Taylor Flat, June 12, no. 3552. The June specimens are in flower; those of the Wicked R. have young berries. — Lesser Slave L. district, *Brinkman*, no. 4263 (N).

**Rubus idaeus** L. var. **strigosus** (Michx.) Maxim.

Lesser Slave L. district, *Brinkman*, no. 4043 (N).

**Rubus parviflorus** Nutt.

Rich woods along Wicked R. near the Peace R., July 14, no. 3800; open place in poplar-spruce woods near upper end of Rocky Mt. Canyon, July 7, no. 3742. In flower.

**Rubus Chamaemorus** L.

Lesser Slave L. district, *Brinkman*, no. 4139 (N).

**Rubus pedatus** Smith.

McLeod L., *John Macoun*, no. 7027 (O).

**Rubus pubescens** Raf. — *R. triflorus* Richards. of Gray's Man. 7th ed. — See Rhod. xi. 236 (1909).

Rich woods along Wicked R. near the Peace R., July 14, no.

3816a, and July 18, no. 3890; rich spruce woods in ravine on high bluff N. W. of Hudson Hope, June 16, no. 3596. The June specimens are in flower; the later ones are maturing fruit. — Halfway R. near Horseshoe Cr., alt. 2300 ft., *Mrs. Henry*, no. 220 (P).

**Rubus arcticus L.**

Frances R., lat. 60°, *Dawson*, no. 5763 (O); near Chandlee R., alt. 2800 ft., *Mrs. Henry*, no. 138 (P).

**Rubus acaulis** Michx. — *R. arcticus* L. var. *grandiflorus* Hook.

Dease L., *Dawson*, no. 5777 (O); Lesser Slave L. district *Brinkman*, nos. 4169, 4275 (N); upper Halfway R., alt. 4000 ft. *Mrs. Henry*, no. 243 (P).

**Fragaria virginiana** Duchesne.

Grazed meadow near Dawson Creek, June 8, no. 3522. In flower. This material is referred somewhat doubtfully to this species.

**Fragaria glauca** (S. Wats.) Rydb.

Turfy ledges, W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4080; damp mossy and sandy banks of Wicked R. near the Peace R., July 16, no. 3852, and July 18, no. 3882. In flower; no. 3852 has ripening fruit also. — Lesser Slave L. district, *Brinkman*, nos. 4270, 4402c, 4404 (N); Sikanni R., alt. 4500 ft., *Mrs. Henry*, nos. 16, 17 (P).

**Fragaria vesca** L. var. *americana* Porter.

Rich woods on high bluff S. of the Peace R. at Hudson Hope, June 24, no. 3637. With flowers and immature fruit. — Lesser Slave L. district, *Brinkman*, no. 4403 (N).

**Potentilla arguta** Pursh. — *Drymocallis agrimonoides* (Pursh) Rydb.

Old Wives L., *J. M. Macoun*, no. 59860 (N, O); Lesser Slave L. district, *Brinkman*, no. 4498 (N).

**Potentilla norvegica** L. var. *hirsuta* (Michx.) Lehm. — *P. monspeliensis* of auth. — See Bibl. Bot. xvi. Heft 71, 404 (1908).

Wet meadow near W. end of Rocky Mt. Portage, Aug. 3, no. 4323. In fruit, but with a few flowers.

**Potentilla dissecta** Pursh.

Turfy slope on Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3943. In flower. — Mountain near Norman R., alt. 5500 ft., *Mrs. Henry*, no. 93 (P); upper Halfway R., alt. 4000 ft., *Mrs. Henry*, no. 249 (P).

**Potentilla nivea** L.

Crevices on W. slope of Mt. Selwyn, alt. 5—6000 ft., July 13, no. 3764, and near small lake, July 26, no. 4124. In flower.

**Potentilla uniflora** Ledeb.

Crevices on W. slope of Mt. Selwyn, alt. about 6000 ft., July 13, no. 3764a. In flower. — Mountain-top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 70 (P).

**Potentilla pulcherrima** Lehm.

Meadow N. of Hudson Hope, June 23, no. 3672. Young plant just beginning to flower. — N. of Dunvegan, *J. M. Macoun*, no. 59861 (O).

**POTENTILLA BIPINNATIFIDA** Dougl.

Lesser Slave L. district, *Brinkman*, 1929.

**Potentilla pennsylvanica** L.

Dry rim of high bluff N. of Hudson Hope, June 23, no. 3669; bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4362. The June specimens are in flower; the later ones in fruit. — Junction of Halfway R., and Graham R., alt. 1900 ft., *Mrs. Henry*, no. 212 (P).

**Potentilla Anserina** L. — *Argentina Anserina* (L.) Rydb.

McLeod L., *Dawson*, 1879, no. 7221 (O).

**Potentilla palustris** (L.) Scop. — *Comarum palustre* L.

Wet meadow near W. end of Rocky Mt. Portage, Aug. 3, no. 4321. In flower. — Lesser Slave L. district, *Brinkman*, no. 4546 (N).

**Potentilla fruticosa** L. — *Dasiphora fruticosa* (L.) Rydb.

Bank of Wicked R. near the Peace R., July 16, no. 3837. In flower. — Frances R., lat. 60°, *Dawson*, no. 7266 (O); Redfern L., alt. 4200 ft., *Mrs. Henry*, no. 34 (P); Mt. of the Gods, near Prophet R., alt. 5500 ft., *Mrs. Henry*, no. 166 (P).

**POTENTILLA TRIDENTATA** Ait. — *Sibbaldiopsis tridentata* (Ait.) Rydb.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Sibbaldia procumbens** L.

Turfy ledges and crevices, W. slope of Mt. Selwyn. Alt. 4—5000 ft., July 19, no. 3972; on N. W. ridge, alt. about 3500 ft., July 23, no. 4057. The first is sterile; the second in flower.

**Geum macrophyllum** Willd. var. **perincisum** (Rydb.) Raup. — *G. perincisum* Rydb. — *G. oregonense* Rydb., not Scheutz. — See Rhod. xxxiii. 172—6 (1931).

Wet meadow near W. end of Rocky Mt. Portage, Aug. 3, no.

4331; poplar woods on S. side of Peace R. at Hudson Hope, June 21, no. 3636. The June specimens are in flower; the later ones in fruit. — Finlayson L., Yukon, *Dawson*, no. 7113 (O); Lesser Slave L. district, *Brinkman*, no. 4294 (C).

**Geum strictum** Ait.

Cabin clearing at mouth of Quartz Cr., July 29, no. 4203; along Rocky Mt. Portage road near Hudson Hope, June 27, no. 3686. In flower; the first also has immature fruit. No. 4203 is referred here somewhat doubtfully. It has slightly glandular styles and also some of the leaf characters of *G. macrophyllum*. Some of its basal leaves have the broad rounded terminal lobes of the latter while others are cleft and divided as in *G. strictum*. — Near Halfway R., alt. 1800 ft., *Mrs. Henry*, no. 185 (P).

**Geum rivale** L.

McLeod L., *Dawson*, 1879, no. 34354 (O); Lesser Slave L. district, *Brinkman*, no. 4210 (N).

**Geum triflorum** Pursh. — *Sieversia triflora* (Pursh) R. Br.

Grassy top and upper slopes of river bluff at Taylor Flat, June 12, no. 3570. With flowers and immature fruit. — Near Halfway R., alt. 2400 ft., *Mrs. Henry*, no. 194 (P).

**Dryas Drummondii** Richards.

Gravel bars at mouth of Wicked R., July 16, no. 3834. With flowers and immature fruit. — Peace R., *John Macoun*, 1872, no. 7088 (O); Henry R., alt. 2300 ft., *Mrs. Henry*, no. 83 (P).

**Dryas integrifolia** Vahl.

Turfy slopes of Mt. Selwyn, alt. 4—6000 ft., July 13, no. 3755; July 19, no. 3934. In flower. — Frances R., lat. 60°, *Dawson*, no. 7092 (O); north slope above Redfern L., alt. 4800 ft., *Mrs. Henry*, no. 39 (P).

**SANGUISORBA CANADENSIS** L. — *Poterium canadense* (L.) Benth. & Hook.

Misinchinca R., *Dawson*, 1879 (noted as *Poterium canadense*).

**Rosa acicularis** Lindl.

Cabin clearing at mouth of Wicked R., July 31, no. 4254; muskeg along Carbon R., Aug. 2, no. 4310; high bluff S. of Peace R. opposite Hudson Hope, June 28, no. 3717; bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4381. The June and July specimens all have young fruit; the later ones nearly all have mature fruit. — Upper Liard R., lat. 60°, *Dawson*, no. 8101 (O); Peace R. Landing, *J. M. Macoun*, nos. 59858,

59859 ? (O); Lesser Slave L. district, *Brinkman*, no. 4305 (N); Caribou Pass, alt. 4500 ft., *Mrs. Henry*, no. 273 (P, A); near Halfway R., alt. 2500 ft., *Mrs. Henry*, no. 195 (P, A); Peace R. near Aylard Cr., alt. 2000 ft., *Mrs. Henry*, no. 335 (P).

**Rosa Woodsii** Lindl.

High bluff N. of Hudson Hope, June 23, no. 3664; river bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4380. The June specimens are in flower; the later ones in fruit. — Peace R., near Aylard Cr., alt. 2000 ft., *Mrs. Henry*, no. 336 (P, A); Pink Mt., alt. 4000 ft., *Mrs. Henry*, no. 240 (P, A); Halfway R., alt. 3200 ft., *Mrs. Henry* (P); near Halfway R., alt. 2500 ft., *Mrs. Henry*, no. 195a (P).

**Prunus demissa** (Nutt.) D. Dietr.

Dry gravelly slope of river bluff at Taylor Flat, June 12, no. 3550; bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4379. The first is in flower; the second in fruit. — Lesser Slave L. district, *Brinkman*, no. 4600 (N); Toad R., alt. 4200 ft., *Mrs. Henry*, no. 117 (P).

**Prunus pensylvanica** L. f.

Dry gravelly slope of river bluff at Taylor Flat, June 12, no. 3551; bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4358. The June specimens have flowers and very young fruits; no. 4358 is sterile. — Lesser Slave L. district, *Brinkman*, nos. 4389, 4613 (N); bank of Peace R., 15 mi. W. of Hudson Hope, *Mrs. Henry*, no. 341 (P, A).

LEGUMINOSAE

**Lupinus arcticus** Wats.

Upper Liard R., lat. 60°, *Dawson*, no. 5537 (G, O); near Redfern L., alt. 3200 ft., *Mrs. Henry*, no. 19 (P).

**LUPINUS NOOTKATENSIS** Donn.—?

Upper Liard R., *Dawson*, 1887.

**LUPINUS POLYPHYLLUS** Lindl.

Near McLeod L., *John Macoun*, 1875.

**Lupinus sericeus** Pursh.

Upper Liard R., lat. 60°, *Dawson*, no. 5537a (O).

**Astragalus frigidus** (L.) Gray. var. **americanus** (Hook.) Wats. — *Phaca americana* (Hook.) Rydb.

Bear Cr., N. of Peace R., *J. M. Macoun*, no. 59853 (N, O).

**Astragalus adsurgens** Pall.

Peace R. Landing, *J. M. Macoun*, no. 59575 (N, O); Pink Mt., alt. 4200 ft., *Mrs. Henry*, no. 236 (P); same, alt. 4000 ft., *Mrs. Henry*, no. 235 (P).

**Astragalus hypoglottis** L.

Peace R. Landing, *J. M. Macoun*, nos. 59847 (O), 59855 (G, N, O).

**Astragalus alpinus** L. — *Tium alpinum* (L.) Rydb.

West and northwest slopes of Mt. Selwyn, alt. 4—5000 ft. July 19, no. 3925; July 23, no. 4066. In flower. — McLeod L., *John Macoun*, no. 4232 (O); forks of Liard and Dease R.'s, *Dawson*, no. 4234 (O); N. of Dunvegan, *J. M. Macoun*, no. 59848 (G, O); near Grimshaw, *Moss*, no. 2243 (G); about 100 mi. N. W. of Ft. St. John, alt. 3000 ft., *Mrs. Henry*, no. 3 (P); mountain-top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 64 (P).

**Astragalus bisulcatus** (Hook.) Gray. — *Diholcos bisulcatus* (Hook.) Rydb.

Peace R. Landing, *J. M. Macoun*, no. 59856 (O).

**Astragalus aboriginum** Richards. — *Atelophragma aboriginum* (Richards.) Rydb.

Dry gravelly slope of river bluff at Taylor Flat, June 12, no. 3576. With flowers and immature fruits. — Pink Mt., alt. 4000 ft., *Mrs. Henry*, no. 238 (P).

**Astragalus aboriginum** Richards. var. *glabriusculus* (Hook.) Rydb. — See Contrib. U. S. Nat. Herb. III. 492 (1896).

Dry gravelly slope of river bluff at Taylor Flat, June 12, no. 3575. With flowers, and pods beginning to mature. These specimens are entirely glabrous.

**Astragalus Forwoodii** Wats. — *Atelophragma Forwoodii* (Wats.) Rydb.

Henry R., alt. 2300 ft., *Mrs. Henry*, no. 86 (P).

**Astragalus eucosmus** B. L. Robinson.

Peace R. Landing, *J. M. Macoun*, no. 59846 (G, N, O); Lesser Slave L. district, *Brinkman*, no. 4328 (C).

**Astragalus tenellus** Pursh. — *Homalobus tenellus* (Pursh) Britton.

High bluff N. of Hudson Hope, June 23, no. 3665; dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug.

15, no. 4369. The first has flowers and very young legumes; the second is in mature fruit. — Peace R. Landing, *J. M. Macoun*, no. 59854 (N, O).

**Oxytropis retrorsa** Fern. var. **sericea** (T. & G.) Fern. — See Rhod. xxx. 140—1 (1928).

Meadow on top of river bluff at Hudson Hope, June 29, no. 3730. With flowers and maturing legumes. — Musqua R., alt. 2600 ft., *Mrs. Henry*, no. 72 (P).

**Oxytropis foliolosa** Hook. — *Aragallus foliolosus* (Hook.) Rydb.

Shore of Redfern L., alt. 4000 ft., *Mrs. Henry*, no. 37 (P).

**Oxytropis hudsonica** (Greene) Fern. — See Rhod. xxx. 142 (1928).

Caribou Pass, alt. 6000 ft., *Mrs. Henry*, no. 516 (P) (1933).

**Oxytropis Maydelliana** Trautv.

Mountain-top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 56 (P).

**Oxytropis arctobia** Bunge.

Crevices and stony slopes on Mt. Selwyn, alt. 5—6000 ft. July 13, nos. 3770, 3773, 3779; July 19, no. 3907. All in flower except no. 3773, which has maturing fruit. — Pass N. E. of Robb L., alt. 5800 ft., *Mrs. Henry*, no. 277 (P); mountain S. of Redfern L., alt. 4500 ft., *Mrs. Henry*, (P).

**Oxytropis** sp.

Near Halfway R., opposite mouth of Graham R., alt. 1900 ft., *Mrs. Henry*, no. 206 (P). This material is of uncertain identity, but seems to be nearest related to *O. campestris* or its American representatives.

**Oxytropis gracilis** (A. Nels.) K. Schum. — *Aragallus gracilis* A. Nels.

Dease L., *Dawson*, no. 5348 (O); Halfway R., alt. 3500 ft., *Mrs. Henry*, no. 21 (P).

**Oxytropis spicata** Hook. — *Aragallus spicatus* (Hook.) Rydb. — See Univ. Wyo. Publ. Bot. I. 109—21 (1926), for a treatment of this and related species.

Dry gravelly river bluff at Taylor Flat, June 12, nos. 3553, 3582. In flower and young fruit. — Slope of Pink Mt., alt. 6000 ft., *Mrs. Henry*, no. 23 (P).

**Oxytropis saximontana** A. Nels.

Turfy slopes on Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3980; gravelly-sandy bank of Wicked R. at its mouth, July 16, no. 3844. The Mt. Selwyn specimens have flowers and young pods; the others are maturing fruit.

**Oxytropis viscidula** (Rydb.) Tidestr.—*Aragallus viscidulus* Rydb.

Upper Liard R., lat. 60°, *Dawson*, no. 5341 (G, O); Dease L., *Dawson*, no. 5338 (O); Redfern L., alt. 4000 ft., *Mrs. Henry*, no. 36 (P).

**Oxytropis splendens** Dougl. — *Aragallus splendens* (Dougl.) Greene.

Meadow on top of river bluff at Hudson Hope, June 19, no. 3617. In flower. — Peace R. Landing, *J. M. Macoun*, no. 59857 (G, N, O); Hythe, *Moss*, no. 2299a (G); mountain N. of Redfern L., alt. 5200 ft., *Mrs. Henry*, no. 296 (P); near Halfway R., alt. 3500 ft., *Mrs. Henry*, no. 12 (P); same, alt. 3200 ft., *Mrs. Henry*, no. 10 (P).

The Rocky Mountain and Hudson Hope specimens cited above are only provisionally placed here, until more material is available.

**GLYCYRRHIZA LEPIDOTA** (Nutt.) Pursh.

Peace R. Pass, *John Macoun*, 1875.

**Hedysarum alpinum** L.

Damp turf slopes and ledges, Mt. Selwyn, alt. 4—5000 ft. July 19, no. 3967; near small lake, July 26, no. 4091. In flower.

**Hedysarum alpinum** L. var. **americanum** Michx. — *H. americanum* (Michx.) Britton.

Upland pine woods at Hudson Hope, June 20, no. 3626. With flowers and immature fruit. — Frances L., *Dawson*, no. 5382 (O); near Halfway R. and mouth of Graham R., alt. 1900 ft., *Mrs. Henry*, no. 211 (P).

**Hedysarum Mackenzii** Richards.

Thickets in scrub timber, W. slope of Mt. Selwyn, alt. about 4000 ft., July 13, no. 3757; gravelly and sandy river banks near the mouth of the Wicked R., July 14, no. 3854; high bluff at Hudson Hope, June 16, no. 3603. The Mt. Selwyn specimens have only flowers; the others are in flower and immature fruit. — Upper Liard R., lat. 60°, *Dawson*, no. 5374 (O); Halfway R., alt. about 2700 ft., *Mrs. Henry*, no. 9 (P); near Sikanni R., alt. 4000

ft., *Mrs. Henry*, no. 25 (P); mountain near Mt. Kenny, alt. 6000 ft., *Mrs. Henry*, no. 283 (P).

**Vicia americana** Muhl.

Lesser Slave L. district, *Brinkman*, nos. 4260, 3091 (C); 100 mi. N. W. of Ft. St. John, alt. 2500 ft., *Mrs. Henry*, no. 4 (P).

**LATHYRUS VENOSUS** Muhl.

Near Ft. St. John, *John Macoun*, 1875.

**LATHYRUS OCHROLEUCUS** Hook.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

GERANIACEAE

**Geranium Bicknellii** Britton.

Roadside near Hudson Hope, June 27, no. 3684. With flowers and immature fruit. — Near High Prairie, *Moss*, no. 2240 (G).

**Geranium Richardsonii** F. & M.

Damp thicket in gully, W. slope of Mt. Selwyn, alt. about 4000 ft., July 13, no. 3791; thicket at base of rock slide along the Wicked R., July 14, no. 3824. In flower. — Lesser Slave L. district, *Brinkman*, no. 4390 (C); base of Pink Mt., alt. 4000 ft., *Mrs. Henry*, no. 22 (P); head of Sukunka R., *Sheldon and Borden*.

LINACEAE

**Linum Lewisii** Pursh.

High bluff N. of Hudson Hope, June 23, no. 3666; dry gravelly slope of river bluff at Taylor Flat, June 12, no. 3578. In flower. — Peace R. Landing, *J. M. Macoun*, no. 59571 (O); near Half-way R., N. of Bear Flats, alt. 2000 ft., *Mrs. Henry*, no. 182 (P).

CALLITRICHACEAE

**Callitricha palustris** L.

Lesser Slave L. district, *Brinkman*, no. 3928 (C).

EMPETRACEAE

**Empetrum nigrum** L.

Thickets near timber line on Mt. Selwyn, July 19, no. 3983; muskeg along Carbon R., Aug. 2, no. 4289. In various stages of fruit. — Lesser Slave L., *John Macoun*, no. 24850 (O).

ACERACEAE

**Acer glabrum** Torr. var. **Douglasii** (Hook.) Dipp.

Rich woods along Wicked R. near the Peace R., July 14, no.

3805; rich spruce-poplar woods near upper end of Rocky Mt. Canyon, July 7, no. 3749. In fruit.

#### BALSAMINACEAE

##### **Impatiens Noli-tangere L.**

Lesser Slave L. district, *Brinkman*, nos. 3928 ? (C), 4651 (N); Ft. St. John, *Moss*, no. 2356 (G); Faust, *Moss*, no. 2402 (G).

#### MALVACEAE

##### **Malvastrum coccineum** (Nutt.) Gray. — *Sphaeralcea coccinea* (Nutt.) Rydb.

Dunvegan, *J. M. Macoun*, no. 59570 (O).

#### VIOLACEAE

##### **Viola nephrophylla** Greene.

Muskeg along Carbon R., Aug. 2, no. 4279. In fruit. — Hythe, *Moss*, no. 2318 (G); foot of Mt. McCusker, alt. 4000 ft., *Mrs. Henry*, no. 320 (P).

##### **Viola palustris** L.

McLeod L., *John Macoun*, no. 2464 (O); Lesser Slave L. district, *Brinkman*, nos. 4162, 4166 (N); Aylard summit, alt. 3300 ft., *Mrs. Henry*, no. 332 (P).

##### **Viola renifolia** Gray var. **Brainerdii** (Greene) Fern.

Rich woods near Peace R., mouth of Quartz Cr., July 29, no. 4215. In fruit. — Between Lesser Slave L. and Peace R., *J. M. Macoun*, no. 59567 (O); Lesser Slave L. district, *Brinkman*, no. 4040 (N); Tetsa R., alt. 3000 ft., *Mrs. Henry*, no. 139 (P).

##### **Viola orbiculata** Geyer.

South of Laurier Pass, alt. 4500 ft., *Mrs. Henry*, no. 495 (P) (1933).

##### **Viola glabella** Nutt.

Head of Sukunka R., *Sheldon and Borden*.

##### **Viola rugulosa** Greene.

Thickets on W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3974; rich thicket at foot of rock slide along Wicked R., July 14, no. 3826; poplar woods at Hudson Hope, June 16, no. 3611. All in flower. — Near Halfway R., alt. 2500 ft., *Mrs. Henry*, no. 196 (P).

##### **Viola adunca** J. E. Sm.

River bluff at Taylor Flat, June 12, no. 3580; grazed meadow

near Dawson Creek, June 8, no. 3528; base of dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4365. The Dawson Creek specimens are in flower; the others are in fruit. — Peace R. Landing, *J. M. Macoun*, no. 59562 (O); Lesser Slave L., *J. M. Macoun*, no. 59565 (G, N, O); near Graham R., alt. 4000 ft., *Mrs. Henry*, no. 328 (P).

#### CACTACEAE

##### **Opuntia polyacantha** Haw.

Dry gravelly river bluff at Taylor Flat, June 12, no. 3586. Sterile specimens. — Smoky R. Mission, *J. M. Macoun*, no. 59868 (O).

#### ELAEAGNACEAE

##### **Elaeagnus argentea** Pursh. — *E. commutata* Bernh.

Bank of Peace R. at the mouth of the Wicked R., July 31, no. 4250; river bluff at Hudson Hope, June 20, no. 3632; dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4382. The June and July specimens are in flower; the later ones are in fruit. — McLeod L., *John Macoun*, no. 23816 (O); Peace R. Landing, *J. M. Macoun*, no. 61270 (O); near Halfway R., alt. 2400 ft., *Mrs. Henry*, no. 192 (P, A).

##### **Shepherdia canadensis** (L.) Nutt. — *Lepargyrea canadensis* (L.) Greene.

Woods along Wicked R., July 18, no. 3892. With maturing fruit. — Near Halfway R., alt. 2400 ft., *Mrs. Henry*, no. 193 (P, A).

##### SHEPHERDIA ARGENTEA Nutt.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

#### ONAGRACEAE

##### **Epilobium angustifolium** L. — *Chamaenerion angustifolium* (L.) Scop.

Cabin clearing at mouth of Wicked R., July 31, no. 4252; springy slope of river bluff at Hudson Hope, June 22, no. 3652. In flower; the first with immature fruit. — Halfway R., alt. 1900 ft., *Mrs. Henry*, no. 213 (P); upper Halfway R., alt. 2900 ft., *Mrs. Henry*, (P).

##### **Epilobium latifolium** L. — *Chamaenerion latifolium* (L.) Sweet.

West slope of Mt. Selwyn, July 26, near small lake, alt. about 5000 ft., no. 4127; gravel bar at mouth of Wicked R., July 16,

no. 3847. In flower. — Swan R., near Lesser Slave L., *John Macoun*, no. 8903 (O); above Redfern L., alt. 4800 ft., *Mrs. Henry*, no. 42 (P).

**Epilobium palustre** L.

Lesser Slave L. district, *Brinkman*, nos. 4429, 4473 (N).

**Epilobium palustre** L. var. **monticola** Haussk.

Muskeg along Carbon R., Aug. 2, no. 4299. In flower.

**Epilobium wyomingense** A. Nels.

Lesser Slave L. district, *Brinkman*, no. 4529 (N).

**Epilobium glandulosum** Lehm. var. **adenocaulon** (Haussk.)

Fern. — *E. adenocaulon* Haussk. — See Rhod. xx. 35 (1918).

Cabin clearing at mouth of Quartz Cr., July 29, no. 4200; wet meadow near W. end of Rocky Mt. Portage, Aug. 3, no. 4329. Both with flowers and immature fruit. — Lesser Slave L. *John Macoun*, no. 8877 (O); Lesser Slave L. district, *Brinkman*, no. 4460 (N).

**Epilobium boreale** Haussk.

Lesser Slave L. district, *Brinkman*, no. 4642 (N).

**Epilobium leptocarpum** Haussk. var. **Macounii** Trel.

Gravelly bank of Carbon R. about 4 mi. above the Peace R., Aug. 2, no. 4272. With flowers and maturing fruit.

**Epilobium alpinum** L.

Mountain near Redfern Valley, alt. 5500 ft., *Mrs. Henry*, no. 308 (P).

**Epilobium lactiflorum** Haussk.

McLeod L., *John Macoun*, no. 8921 (O). Listed under *E. alpinum* var. *nutans* in Macoun's Cat.

**Epilobium Hornemannii** Reich.

Thicket near timber line on W. slope of Mt. Selwyn, July 23, no. 4048. With flowers and immature fruit. — Above Robb L., alt. 5500 ft., *Mrs. Henry*, no. 259a (P); head of Sukunka R., *Sheldon and Borden*.

**GAURA GLABRA** Lehm.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Circaeа alpina** L.

Rich woods along Peace R. near mouth of Quartz Cr., July 29, no. 4204. With flowers and fruit, mainly the latter. — Lesser Slave L. district, *Brinkman*, no. 4360 (N).

**CIRCAEA PACIFICA** Asch. & Magn.

Lesser Slave L. district, *Brinkman*, 1929.

## HIPPURIDACEAE

**Hippuris vulgaris** L.

Slough along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4355. In late flower. — Besa R., alt. 4000 ft., *Mrs. Henry*, no. 298 (P).

## ARALIACEAE

**Oplopanax horridum** (J. E. Sm.) Miq. — *Echinopanax horridum* (J. E. Sm.) Dec. & Planch. — See Rhod. xxvi. 123—4 (1924).

Rich woods along Peace R. near mouth of Quartz Cr., July 29, no. 4196; gully in spruce woods near upper end of Rocky Mt. Canyon, July 7, no. 3741. The first has maturing fruit; the second is in flower. — Lesser Slave L. district, *Brinkman*, no. 4334 (N).

**Aralia nudicaulis** L.

High bluff N. W. of Hudson Hope, June 16, no. 3605; poplar woods S. of Peace R. opposite Hudson Hope, June 28, no. 3716. In flower and immature fruit. — Lesser Slave L. district, *Brinkman*, no. 4200 (N); Toad R., alt. 4200 ft., *Mrs. Henry*, no. 124 (P).

## UMBELLIFERAE

**Sanicula marylandica** L.

Along Rocky Mt. Portage road near Hudson Hope, June 27, no. 3689; poplar thicket at Hudson Hope, June 29, no. 3727. In flower. — Peace R. Landing, *J. M. Macoun*, no. 59872 (O).

**Osmorrhiza obtusa** (Coulter & Rose) Fern.

Rich woods along Wicked R. near the Peace R., July 18, no. 3878; moist gully near upper end of Rocky Mt. Canyon, July 7, no. 3743; rich woods S. of the Peace R. opposite Hudson Hope, June 21, no. 3640. The June specimens are in flower; the later ones have immature fruit. — Lesser Slave L. district, *Brinkman*, nos. 4022, 4072, 4335 (C).

**CICUTA MACULATA** L. — possibly *C. OCCIDENTALIS* Greene.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Sium suave** Walt. — *S. cicutaefolium* Gmel. of auth. — See Rhod. xvii. 131 (1915).

Lesser Slave L. district, *Brinkman*, no. 4504 (N).

**Zizia cordata** (Walt.) Koch.

Grazed meadows and thickets near Dawson Creek, June 8, no. 3529. In flower.

**Angelica genuflexa** Nutt.

Lesser Slave L. district, *Brinkman*, no. 4382 (C).

**ANGELICA LYALLII** Wats.

Lesser Slave L. district, *Brinkman*, 1928.

**Heracleum lanatum** Michx.

Moist thicket in gully on W. slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4175; opening in spruce-poplar woods near upper end of Rocky Mt. Canyon, July 7, no. 3752. In flower; the first with immature fruit. — Head of Sukunka R., *Sheldon and Borden*.

## CORNACEAE

**Cornus canadensis** L. — *Chamaepericlymenum canadense* (L.) Aschers. & Graebn.

Rich woods along Wicked R. near the Peace, July 18, no. 3879. In flower. — Near Falk R., alt. 2800 ft., *Mrs. Henry*, no. 107 (P).

**Cornus stolonifera** Michx.

Bank of the Wicked R. near the Peace R., July 18, no. 3888; flood plain along Peace R. near Taylor Flat, June 12, no. 3584. In flower; the first with very young fruit. — Lesser Slave L. district, *Brinkman*, no. 4228 (N); Toad R., alt. 4200 ft., *Mrs. Henry*, no. 114 (P); Peace R., 15 mi. W. of Hudson Hope, *Mrs. Henry*, no. 342 (P, A).

**Cornus stolonifera** Michx. var. **Baileyi** (Coul. & Evans), comb. nov.—*C. Baileyi* Coul. & Evans, Bot. Gaz. xv. 37—8 (1890).

Spruce woods along bank of Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4374. In fruit. — Lesser Slave L. district, *Brinkman*, no. 4236 (N).

The writer has been, for the most part, quite unable to separate the northwestern red-osier dogwoods from the eastern *C. stolonifera*, although this is commonly done. However, some specimens collected in the lower Peace River region have very woolly branchlets, and seem to be identical with the form originally described as *C. Baileyi*. Fruit characters which have been used to distinguish this as a species have thus far proven unsatisfactory, and it seems justifiable, therefore, to maintain it only as a variety.

## PYROLACEAE

**Chimaphila umbellata** (L.) Bartr. var. **occidentalis** (Rydb.) Blake. — See Rhod. xix. 237—44 (1917).

Rich woods along Wicked R. near the Peace R., July 30, no. 4238. In flower.

**Moneses uniflora** (L.) Gray.

Mossy bank of Quartz Cr. near the Peace R., July 21, no. 3998; muskeg along Carbon R., Aug. 2, no. 4304; rich woods in ravine on high bluff N. W. of Hudson Hope, June 27, no. 3696. In flower.

**Pyrola minor** L. — *Erxlebenia minor* (L.) Rydb.

Rich thickets near timber line, W. and N. W. slopes of Mt. Selwyn, alt. 3—4000 ft., July 13, no. 3796; July 22, no. 4027; July 23, no. 4059; July 26, no. 4184; rich woods along Wicked R. near the Peace R., July 14, no. 3821. All in flower, or the latest with immature fruit. — Mountain at head of Besa R., alt. 5500 ft., *Mrs. Henry*, (P).

**Pyrola secunda** L. — *Ramischia secunda* (L.) Garcke.

Rich woods along Wicked R. near the Peace R., July 14, no. 3829, and July 18, no. 3875. In flower.

**Pyrola chlorantha** Sw.

Rich woods along Wicked R. near the Peace R., July 18, no. 3877, and along the Peace R. near the mouth of Quartz Cr., July 29, no. 4206; pine woods on river bluff near Hudson Hope, June 20, no. 3628; rich woods in ravine on high bluff N. W. of Hudson Hope, June 27, no. 3692. With flowers and a few immature fruits. — Island Cr., N. of Dunvegan, *J. M. Macoun*, no. 61245 (O); mountain S. of Redfern L., alt. 4200 ft., *Mrs. Henry*, no. 38 (P).

**Pyrola grandiflora** Radius.

Damp turf slopes on Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3927. In flower. — Mountains S. of Redfern L., alt. 4200 ft., *Mrs. Henry*, no. 47 (P); N. of Caribou Pass, alt. 5500 ft., *Mrs. Henry*, no. 282 (P).

**Pyrola asarifolia** Michx.

Rich woods at N. W. base of Mt. Selwyn, near mouth of Quartz Cr., July 21, no. 3995. In flower.

**Pyrola asarifolia** Michx. var. **incarnata** (Fisch.) Fern.

Rich woods at N. W. base of Mt. Selwyn, July 19, no. 3935; muskeg along Carbon R., Aug. 2, no. 4280; rich woods in ravine on high bluff N. W. of Hudson Hope, June 27, no. 3693. In flower. — Peace R. Landing, *J. M. Macoun* no. 61244 (O);

mountain S. of Redfern L., alt. 5000 ft., *Mrs. Henry*, no. 50 (P).

**Pyrola elliptica** Nutt.

Lesser Slave L. district, *Brinkman*, no. 4534 (N).

ERICACEAE

**Ledum groenlandicum** Oeder.

Muskeg along Carbon R., Aug. 2, no. 4309; upland pine woods near Hudson Hope, June 20, no. 3627. The June specimens are in flower; the others have maturing fruit. — McLeod L., *John Macoun*, no. 15639 (O); Lesser Slave L. district, *Brinkman*, no. 4213 (N); Henry R., alt. 3000 ft., *Mrs. Henry*, no. 144 (P).

**Rhododendron lapponicum** (L.) Wahl.

Mountain above Redfern L., alt. 5500 ft., *Mrs. Henry*, no. 41 (P).

**Rhododendron albiflorum** Hook.

Thickets at or near timber line on Mt. Selwyn, July 13, no. 3793, and July 19, no. 3911. In flower. — Mountain side just N. of Caribou Pass, alt. 5200 ft., *Mrs. Henry*, no. 290 (P, A).

**Loiseleuria procumbens** (L.) Desv.

Mountain near Aylard Cr., alt. 5200 ft., *Mrs. Henry*, no. 176 (P).

**Kalmia polifolia** Wang.

McLeod L., *John Macoun*, (O).

**Phyllodoce empetriformis** (Smith) D. Don.

Damp mossy ledges, W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4076. In flower. — N. of Graham R., alt. 5000 ft., *Mrs. Henry*, no. 154 (P); N. of Robb L., *Mrs. Henry*, no. 280 (P, A).

**Phyllodoce glanduliflora** (Hook.) Cov.

Damp mossy ledges, W. slope of Mt. Selwyn, alt. about 5000 ft., July 26, no. 4077. In flower. It should be noted that both this and the preceding were just beginning to blossom when they were collected. — Basin above Robb L., alt. 6000 ft., *Mrs. Henry*, no. 272 (P, A).

**Cassiope tetragona** D. Don.

Turfy ledges and slopes on Mt. Selwyn, alt. about 5000 ft., July 13, no. 3778, and near small lake, July 26, no. 4119. In flower. — Near Graham R., alt. 4500 ft., *Mrs. Henry*, no. 155 (P); near Norman R., alt. 6000 ft., *Mrs. Henry*, no. 96 (P); basin above Robb L., alt. 6200 ft., *Mrs. Henry*, no. 271 (P, A).

**Cassiope Mertensiana** Don.

Basin above Robb L., alt. 6200 ft., *Mrs. Henry*, no. 271a (P).

**Andromeda Polifolia** L.

McLeod L., *John Macoun*, no. 15542 (O); Lesser Slave L. district, *Brinkman*, no. 4518 (N); near Blue L., alt. 3200 ft., *Mrs. Henry*, no. 76 (P).

**Chamaedaphne calyculata** (L.) Moench.

Lesser Slave L. district, *Brinkman* (coll. by McBean), no. 4519 (N); near Tetsa R., alt. 2500 ft., *Mrs. Henry*, no. 135 (P).

**Arctostaphylos Uva-ursi** (L.) Spreng.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872; common, *Raup*, 1932.

**Arctostaphylos Uva-ursi** (L.) Spreng. var. **adenotricha** Fern. & Macbr. — See Rhod. xvi. 211—13 (1914).

Dry woods along Wicked R. near the Peace R., July 30, no. 4226. With immature fruit.

**Arctostaphylos rubra** (Rehder & Wilson) Fern. — *A. alpina* (red-fruited form) Richards. — *Mairania alpina* (red-fruited form) Britton & Rydb. — *Arctous alpina* Niedenz. var. *rubra* Rehd. & Wils. — See Rhod. xvi. 32 (1914).

Turfy slopes on Mt. Selwyn, alt. about 5000 ft., July 13, no. 3783; muskeg along Carbon R., Aug. 2, no. 4302. The first is in flower; the second sterile. — Besa R., alt. 4000 ft., *Mrs. Henry*, no. 151 (P).

**Chiogenes hispidula** (L.) T. & G.

Muskeg along Carbon R., Aug. 2, no. 4301. In fruit. — Lesser Slave L. district, *Brinkman*, no. 4387 (N).

**Vaccinium canadense** Kalm. — *Cyanococcus canadensis* (Richards.) Rydb.

McLeod L., *John Macoun*, no. 15342 (O); Lesser Slave L. district, *Brinkman*, nos. 4304, 4394 (N); Peace R., 15 mi. W. of Hudson Hope, alt. 1800 ft., *Mrs. Henry*, no. 345 (P, A).

**Vaccinium uliginosum** L.

Frances R., lat. 61°, *Dawson*, no. 101368 (O).

**Vaccinium caespitosum** Michx.

Burned-over pine woods on upland N. W. of Hudson Hope, June 16, no. 3612. In flower. — McLeod L., *John Macoun*, no. 1129 (O); Dease R., *Dawson*, no. 15361 (O); canyon of the upper Liard R., lat. 60°, *Dawson*, no. 101345 (O); Island Cr., N. of

Dunvegan, *J. M. Macoun*, no. 61243 (G, N); Lesser Slave L. district, *Brinkman*, no. 4300 (N); pass near Summit L., alt. 4200 ft., *Mrs. Henry*, no. 31 (P); S. fork of Nelson R., alt. 4500 ft., *Mrs. Henry*, no. 163 (P).

**Vaccinium membranaceum** Dougl.

Rich woods along Wicked R., July 14, no. 3799. With immature fruit. — Near Lesser Slave L., *John Macoun*, no. 101354 (O) (*V. myrtilloides* var. *rigidum* of Macoun's Cat.); S. fork of Nelson R., alt. 4500 ft., *Mrs. Henry*, no. 164 (P); mountain side N. of Caribou Pass, alt. 5200 ft., *Mrs. Henry*, no. 291 (P, A).

**Vaccinium Vitis-Idaea** L. var. **minus** Lodd. — *Vitis-Idaea Vitis-Idaea* (L.) Britton.

Muskeg along Carbon R., Aug. 2, no. 4285. In fruit. — Lesser Slave L. district, *Brinkman*, no. 4256 (N); near Besa R., alt. 4000 ft., *Mrs. Henry*, no. 171 (P); N. of Caribou Pass, alt. 5200 ft., *Mrs. Henry*, no. 280 (P); Caribou Pass, alt. 4500 ft., *Mrs. Henry*, no. 329 (P).

**Vaccinium Oxycoccus** L. — *Oxycoccus Oxycoccus* (L.) MacM.

Muskeg along Carbon R., Aug. 2, no. 4269. In fruit. — McLeod L., *John Macoun*, no. 15404 (O); Lesser Slave L. district, *Brinkman*, no. 3893 (N); Pink Mt., alt. 4200 ft., *Mrs. Henry*, no. 29 (P).

PRIMULACEAE

**Primula incana** M. E. Jones. — See Rhod. xxx. 59 (1928).

Springy slope of river bluff at Hudson Hope, June 22, no. 3657. In flower.

**Primula mistassinica** Michx.

Frances R., lat. 61°, *Dawson*, no. 15844 (O).

**Primula egaliksensis** Wormsk. — See Rhod. xxx. 59 (1928).

Pass opposite Mt. Kenny, alt. 5500 ft., *Mrs. Henry*, no. 289 (P); upper Graham R., alt. 4000 ft., *Mrs. Henry*, no. 330 (P); N. of Caribou Pass, alt. 5500 ft., *Mrs. Henry*, no. 292 (P).

**Androsace septentrionalis** L. — See Mem. 126, no. 4, Biol. Ser. Dept. of Mines, Can. 45 (1922).

Grazed meadow near Dawson Creek, June 8, no. 3523. In flower. This probably represents the so-called var. *diffusa* (Small) R. Kunth, but it is doubtful if this can be considered as more than an ecological form. — Lesser Slave L., *J. M. Macoun*, no. 61246 (G, N, O); basin above Robb L., alt. 6000 ft., *Mrs. Henry*, no. 262b (P).

**Dodecatheon frigidum** Cham. & Schl.Caribou Pass, alt. 5000 ft., *Mrs. Henry*, no. 274 (P).*LYSIMACHIA THYRSIFLORA* L. — *Naumbergia thyrsiflora* (L.) Duby.Lesser Slave L. district, *Brinkman*, 1929.**Trientalis borealis** Raf. — *T. americana* (Pers.) Pursh. —

See Rhod. xi. 236 (1909).

Lesser Slave L. district, *Brinkman*, no. 4159 (N).**Trientalis europaea** L. var. **arctica** (Fisch.) Ledeb. — *T. arctica* Fisch.Lesser Slave L. district, *Brinkman*, nos. 4023, 4279 (N).**Glaux maritima** L.Peace R. Landing, *J. M. Macoun*, no. 61248 (O).

## GENTIANACEAE

**Gentiana Amarella** L. — *Amarella plebeia* (Cham.) Greene.

W. slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4187.

In flower. — Spirit R., S. of Dunvegan, *J. M. Macoun*, no. 61250 (O); Lesser Slave L. district, *Brinkman*, no. 4512 (N).**Gentiana propinqua** Richards. — *Amarella propinqua* (Richards.) Greene.Damp ledges and slopes, Mt. Selwyn, alt. about 4000 ft., July 23, nos. 4055, 4065, and July 26, no. 4187a; damp sandy bank of Wicked R. near the Peace R., July 30, no. 4231. In flower. — Finlayson L., lat. 61°, *Dawson*, no. 101424 (O); Caribou Pass, alt. 6000 ft., *Mrs. Henry*, no. 295 (P); Musqua R., alt. 2600 ft., *Mrs. Henry*, no. 74 (P); S. fork of Nelson R., alt. 4500 ft., *Mrs. Henry*, no. 159 (P).**Gentiana prostrata** Haenke.Damp ledges and slopes, Mt. Selwyn. Alt. 4—5000 ft., July 23, nos. 4046, 4054; alt. about 5000 ft., July 26, no. 4192. In flower. The American representative of this species has commonly been recognized as var. *americana* Engelm. (*Chondrophylla americana* A. Nels.), and distinguished as always having 4-merous corollas, instead of 4- or 5-merous as in the Eurasian plant. The northern material, however, is like the latter in having both. — Near Halfway R., alt. 3800 ft., *Mrs. Henry*, no. 27 (P); basin above Robb L., alt. 6000 ft., *Mrs. Henry*, no. 261 (P).**Gentiana glauca** Pall.Caribou Pass, alt. 5500 ft., *Mrs. Henry*, no. 284 (P).

**Lomatogonium rotatum** (L.) Fries. — *Pleurogyne rotata* (L.) Griseb.

Bank of Henry R., alt. 4000 ft., *Mrs. Henry*, no. 149 (P).

**Halenia deflexa** (Smith) Griseb. — *Tetragonanthus deflexus* (Smith) Ktze.

Near Henry R., alt. 2500 ft., *Mrs. Henry*, no. 174 (P).

**Menyanthes trifoliata** L.

Muskeg along Carbon R., Aug. 2, no. 4290. Sterile.

#### APOCYNACEAE

**Apocynum androsaemifolium** L.

High bluff N. W. of Hudson Hope, June 16, no. 3598; bank of Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 49. The June specimen is in flower; the later one has flowers and immature fruit. — Peace R. Landing, *J. M. Macoun*, no. 61251 (O); along Peace R., near Aylard Cr., *Mrs. Henry*, no. 333 (P); Peace R. near Hudson Hope, *Mrs. Henry*, no. 346 (P).

**Apocynum cannabinum** L. — probably *A. hypericifolium* Ait.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

#### ASCLEPIADACEAE

**Asclepias ovalifolia** Decsne.

Peace R. Landing, *J. M. Macoun*, no. 61250 (O).

#### POLEMONIACEAE

**Polemonium coeruleum** L. var. **acutiflorum** (Willd.) Ledeb.

Finlayson R., lat. 61°, *Dawson*, no. 16228 (O); Island Cr., N. of Dunvegan, *J. M. Macoun*, no. 61253 (O); Lesser Slave L. district, *Brinkman*, no. 4551 (N); along Halfway R., alt. 2500 ft., *Mrs. Henry*, no. 5 (P).

**Polemonium lanatum** Pall.

Mountain above Redfern L., alt. 6000 ft., *Mrs. Henry*, no. 314 (P); Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 63 (P); head of Sukunka R., *Sheldon and Borden*.

**Collomia linearis** Nutt. — *Gilia linearis* (Nutt.) Gray.

Peace R. Landing, *J. M. Macoun*, no. 61254 (N, O); near Halfway R. and Horseshoe Cr., alt. 2300 ft., *Mrs. Henry*, no. 221 (P).

#### HYDROPHYLACEAE

**Phacelia Franklinii** R. Br.

About 100 mi. N. W. of Ft. St. John, alt. 3000 ft., *Mrs. Henry*, no. 2 (P).

## BORAGINACEAE

**Lappula Redowskii** (Hornem.) Greene var. **occidentalis** (Wats.) Rydb.

Near Halfway R., alt. 1800 ft., *Mrs. Henry*, no. 183 (P).

**Myosotis alpestris** Schmidt.

Turfy ledges and slopes, Mt. Selwyn, alt. 4—6000 ft. July 13, no. 3768; July 19, no. 3938; near small lake, July 26, no. 4125. In flower. — Pass near Summit L., alt. 4200 ft., *Mrs. Henry*, no. 33 (P); mountain top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 68 (P); head of Sukunka R., *Sheldon and Borden*.

**Mertensia paniculata** (Ait.) Don.

Damp turf ledges, W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3940; rich woods along Wicked R. near the Peace R., July 18, no. 3871; poplar woods at Hudson Hope, June 21, no. 3633; poplar thicket along Dawson Cr., June 8, no. 3511. All in flower; the July 18 specimens have also immature fruits. — Near Halfway R., alt. 2400 ft., *Mrs. Henry*, no. 204 (P); mountain top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 61 (P); pass above Halfway R., alt. 4000 ft., *Mrs. Henry*, no. 53 (P); Robb L., alt. 4000 ft., *Mrs. Henry*, no. 244 (P).

**Lithospermum incisum** Lehm. — *L. angustifolium* Michx. not Forsk. — *L. linearifolium* Goldie.

Dry bank N. of Peace R., alt. 1200 ft., *Mrs. Henry*, no. 382 (P) (1933); N. of Peace R. near "12 mile", *Mrs. Henry*, no. 425 (P) (1933).

## LABIATAE

**Scutellaria epilobiifolia** Hamilton. — *S. galericulata* Amer. auth., not L. — See Rhod. xxiii. 86 (1921).

Along Rocky Mt. Portage road near Hudson Hope, Aug. 6, no. 4337. With flowers and maturing fruit. — Lesser Slave L. district, *Brinkman*, no. 4536 (N); near Halfway R., alt. 2200 ft., *Mrs. Henry*, no. 187 (P).

**Dracocephalum parviflorum** Nutt. — *Moldavica parviflora* (Nutt.) Britton.

Along Rocky Mt. Portage road near Hudson Hope, June 27, no. 3685. In flower. — Hythe, *Moss*, no. 2307 (G); Lesser Slave L. district, *Brinkman*, no. 4247 (N).

**AGASTACHE FOENICULUM** (Pursh) Ktze. — *Lophanthus anisatus* Benth.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872;

Dunvegan, *Dawson*, 1879, (noted by both as *Lophanthus anisatus*).  
**NEPETA CATARIA** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Prunella vulgaris** L. var. **lanceolata** (Bart.) Fern. — See Rhod. xv. 179—86 (1913).

Damp sandy river bank at head of Rocky Mt. Canyon, July 7, no. 3736. In flower. This material may be identified as forma *iodocalyx* Fern.

**Galeopsis Tetrahit** L.

Lesser Slave L. district, *Brinkman*, no. 4650 (N).

**Stachys scopulorum** Greene.

Sixty mi. N. W. of Ft. St. John, alt. 2700 ft., *Mrs. Henry*, no. 6 (P).

**Monarda mollis** L. var. **menthaefolia** Fern. — See Rhod. III. 15 (1901).

Dunvegan, *J. M. Macoun*, no. 61264 (O); Taylor Flat, *Moss*, no. 2347 (G); near Halfway R., N. of Bear Flats, alt. 1800 ft., *Mrs. Henry*, no. 191 (P).

**Mentha canadensis** L. var. **glabrata** Benth.

Lesser Slave L. district, *Brinkman*, no. 4586 (N); Toad R., alt. 4200 ft., *Mrs. Henry*, no. 112 (P).

**Mentha occidentalis** Rydb.

Lesser Slave L. district, *Brinkman*, no. 4514 (N).

### SCROPHULARIACEAE

**Penstemon gracilis** Nutt.

Peace R. Landing, *J. M. Macoun*, no. 61261 (O).

**Penstemon procerus** Dougl.

Near Halfway R., alt. 3000 ft., *Mrs. Henry*, no. 175 (P); upper Halfway R., alt. 3000 ft., *Mrs. Henry*, (P).

**Mimulus guttatus** DC. — See Ann. Mo. Bot. Gard. xi. 157 (1924).

Springy slope of river bluff at Hudson Hope, June 22, no. 3650. In flower.

**Veronica americana** Schwein.

Willow-alder thickets in sloughs along Peace R. about 6 mi. below the Wicked R., July 22, no. 4021. With flowers and maturing fruit. — Lesser Slave L. district, *Brinkman*, no. 4333 (N); Halfway R., near Horseshoe Cr., alt. 2200 ft., *Mrs. Henry*, no. 214 (P); bank of Halfway R., alt. 3200 ft., *Mrs. Henry*, no. 229 (P).

**Veronica scutellata** L.

Lesser Slave L. district, *Brinkman*, no. 4319 (N).

**Veronica Wormskjoldii** R. & S. — *V. alpina* L. var. *unaliaschensis* Cham. & Schl. — See *Rhod.* xxiii. 15 (1921).

West slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4168. In flower. — McLeod L., John Macoun, no. 17771 (O); Finlayson L. and R., lat. 61°, *Dawson*, nos. 17765, 101526 (O); Robb L., alt. 4000 ft., *Mrs. Henry*, no. 255 (P); Caribou Pass, alt. 5000 ft., *Mrs. Henry*, no. 324 (P).

**Veronica humifusa** Dickson. — *V. serpyllifolia* L. var. *humifusa* (Dickson) Vahl.

Meadow near Graham R., alt. 4000 ft., *Mrs. Henry*, no. 500 (P) (1933).

**Veronica peregrina** L. var. *xalapensis* (HBK.) Pennell. — *V. xalapensis* HBK. — See *Torreya*, xix. 167 (1919).

Lesser Slave L. district, *Brinkman*, no. 4559 (N).

**Castilleja miniata** Benth.

Thickets on slope of Mt. Selwyn, alt. about 3000 ft., July 13, no. 3795. — Little Burnt R., N. of Peace R., *J. M. Macoun*, no. 61255 (G, O); Lesser Slave L. district, *Brinkman*, no. 4418 (C); Halfway R., N. of Bear Flats, alt. 1800 ft., *Mrs. Henry*, no. 188 (P); upper Halfway R., alt. 4000 ft., *Mrs. Henry*, no. 250 (P); Caribou Pass, alt. 5000 ft., *Mrs. Henry*, no. 322 (P).

**Castilleja** sp.\*

West slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3944; high bluff N. W. of Hudson Hope, June 16, no. 3602. In flower. — Near upper Halfway R., alt. 2800 ft., *Mrs. Henry*, nos. 230, 231 (P).

**Castilleja** sp.

Mountain at head of Besa R., alt. 5500 ft., *Mrs. Henry*, no. 303 (P, G).

**Castilleja** sp.

White Mud R., *J. M. Macoun*, no. 61256 (G, N, O); Toad R., alt. 4200 ft., *Mrs. Henry*, no. 120 (P).

\*This and the two following species of *Castilleja* are new. Dr. Francis W. Pennell who has studied the material, and to whom the writer is indebted for the following analysis of the specimens at hand, will present descriptions of the novelties in a forthcoming revision.

**Orthocarpus luteus** Nutt.

Dunvegan, *J. M. Macoun*, no. 61260 (O).

**RHINANTHUS MINOR** Ehrh. — possibly *R. KYROLLAE* Chabert.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Pedicularis groenlandica** Retz. — *Elephantella groenlandica* (Retz.) Rydb.

Bear Cr., N. of Peace R., *J. M. Macoun*, no. 61258 (N, O).

**Pedicularis labradorica** Houttuyn. — See Rhod. XXXIII. 193 (1931).

Turfy slopes of Mt. Selwyn, near small lake, alt. about 5000 ft., July 26, no. 4143. In flower. — Frances L., *Dawson*, no. 17635 (O); Island Cr., N. of Dunvegan, *J. M. Macoun*, no. 61257 (N, O); Lesser Slave L. district, *Brinkman*, nos. 4056, 4316 (N).

**Pedicularis bracteosa** Benth.

Thickets near timber line on Mt. Selwyn, alt. 3—4000 ft. July 13, no. 3792; July 23, no. 4058. In flower. — Caribou Pass, alt. 4500 ft., *Mrs. Henry*, no. 323 (P).

**Pedicularis sudetica** Willd.

Finlayson R., lat. 61°, *Dawson*, no. 16653 (O); near Sikanni R., alt. 3500 ft., *Mrs. Henry*, no. 20 (P); shore of Robb L., alt. 4200 ft., *Mrs. Henry*, no. 253 (P).

**Pedicularis Oederi** Vahl.

Sikanni R., alt. 4200 ft., *Mrs. Henry*, no. 35 (P); above Robb L., alt. 5000 ft., *Mrs. Henry*, no. 269 (P); mountain S. of Redfern L., alt. 5500 ft., *Mrs. Henry*, no. 45 (P).

**Pedicularis lanata** Cham. & Schlecht.

Damp stony slopes on Mt. Selwyn, alt. about 6000 ft., July 13, no. 3769. In flower. — Caribou Pass, alt. 5500 ft., *Mrs. Henry*, (P); mountain top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, nos. 67, 71 (P); basin above Robb. L., alt. 5500 ft., *Mrs. Henry*, (P); mountain S. of Redfern L., alt. 5200 ft., *Mrs. Henry*, no. 46 (P).

**Pedicularis capitata** Adams.

Turfy ledges and slopes on Mt. Selwyn, alt. 4—5000 ft. July 13, no. 3781; July 19, no. 3959; July 26, no. 4108. In flower. — Basin above Robb L., alt. 6000 ft., *Mrs. Henry*, no. 262a (P); mountain S. of Redfern L., alt. 5500 ft., *Mrs. Henry*, no. 44 (P); same, alt. 5000 ft., *Mrs. Henry*, no. 43 (P).

**Melampyrum lineare** Lam.

McLeod L., *Dawson*, 1879, no. 17478 (O); Lesser Slave L. district, *Brinkman*, nos. 4510, 4063 (N).

## OROBANCHACEAE

**Orobanche fasciculata** Nutt. — *Thalesia fasciculata* (Nutt.)

Britt. — See Bull. Torr. Bot. Club, LX. 441—51 (1933).

Sand bank above Peace R., *Mrs. Henry*, no. 396 (P) (1933).

## LENTIBULARIACEAE

**Pinguicula vulgaris** L.

Damp mossy-sandy bank of Wicked R. near the Peace R., July 20, no. 3988; springy slope of river bank at Hudson Hope, June 19, no. 3616, and June 22, no. 3651. In flower.

**Pinguicula villosa** L.

Frances L., lat. 61°, *Dawson*, no. 17873 (O).

**Utricularia vulgaris** L.

Upland slough near Hudson Hope, June 27, nos. 3711, 3712. Sterile.

## PLANTAGINACEAE

**Plantago major** L. var. **asiatica** Decaisne.

Near hot spring, Toad R., alt. 4200 ft., *Mrs. Henry*, no. 111 (P).

**Plantago eriopoda** Torr.

White Mud R., *J. M. Macoun*, no. 61265 (N, O).

## RUBIACEAE

**Galium boreale** L.

Gravelly shore of Wicked R. near the Peace R., July 16, no. 3857; muskeg along Carbon R., Aug. 2, no. 4278; dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4360. The first two are in flower; the last is in fruit. — Peace R. Landing, *J. M. Macoun*, no. 59979 (O); above Cameron Cr., alt. 2400 ft., *Mrs. Henry*, no. 200 (P).

**Galium trifidum** L.

Lesser Slave L. district, *Brinkman*, nos. 3957, 4505 (N).

**Galium labradoricum** Wieg.

Lesser Slave L. district, *Brinkman*, no. 4530 (N).

**Galium triflorum** Michx.

Cabin clearing along Peace R. at mouth of Quartz Cr., July 29, no. 4198; rich woods high on S. slope of Peace R. valley op-

posite Hudson Hope, June 28, no. 3723. The June specimens are in flower; those from Quartz Cr. have flowers and immature fruit. — Peace R. Landing, *J. M. Macoun*, no. 59978 (O).

#### CAPRIFOLIACEAE

##### **Sambucus pubens** Michx.

In damp gully on W. slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4167; thicket at foot of rock slide along Wicked R., July 14, no. 3803. With immature fruit. — Lesser Slave L. district, *Brinkman*, nos. 4461 (N), 4449 ? (C).

##### **Viburnum pauciflorum** Raf.

Woods along Wicked R. near the Peace R., July 18, no. 3891; poplar woods at Hudson Hope, June 16, no. 3606; poplar woods on bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4378. The June specimens are in flower; those of July with immature fruit; and those of August with ripe berries. — Lesser Slave L. district, *Brinkman*, no. 4163a (N).

##### **Symphoricarpos occidentalis** Hook.

Dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4388. In flower and immature fruit. — Lesser Slave L. district, *Brinkman*, no. 4086 (N); Toad R., alt. 4200 ft., *Mrs. Henry*, no. 109 (P); near Halfway R., alt. 2200 ft., *Mrs. Henry*, (P).

**Symphoricarpos albus** (L.) Blake var. **pauciflorus** (Robbins) Blake. — *S. pauciflorus* (Robbins) Britton. — *S. racemosus* Michx. var. *pauciflorus* Robbins. — See Rhod. xvi. 119 (1914).

Slope of river bluff at Hudson Hope, June 22, no. 3654; dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4387. The June specimens are in flower; the later ones are in fruit. — Lesser Slave L. district, *Brinkman*, no. 4263a (N); junction of Halfway and Graham R.'s, alt. 1900 ft., *Mrs. Henry*, no. 208 (P, A).

**Linnaea borealis** L. var. **americana** (Forbes) Rehder. — *L. americana* Forbes.

Rich woods along Wicked R., July 14, no. 3815; rich spruce woods in ravine on high bluff N. W. of Hudson Hope, June 27, no. 3697; woods at Hudson Hope, June 19, no. 3618; spruce-poplar woods on upland S. of Peace R. opposite Hudson Hope, June 21, no. 3634. In flower. — Near Henry R., alt. 2300 ft.,

*Mrs. Henry*, no. 137 (P); above Cameron Cr., alt. 2400 ft., *Mrs. Henry*, no. 201 (P).

**Lonicera villosa** (Michx.) R. & S. var. **Solonis** (Eat.) Fern. — See *Rhod.* xii. 209—11 (1910); xxvii, 1—11 (1925).

Lesser Slave L. district, *Brinkman*, nos. 3913, 4249 (N).

**Lonicera glaucescens** Rydb.

Fence-row at Hudson Hope, June 29, no. 3728; lower part of dry river bluff at Taylor Flat, June 12, no. 3562. In flower. — Peace R. Landing, *J. M. Macoun*, no. 59980 (N, O); along Halfway R., alt. 2500 ft., *Mrs. Henry*, no. 207 (P, A).

**Lonicera involucrata** Banks.

Rich woods along Wicked R., July 14, no. 3801. With immature fruit.

#### ADOXACEAE

**Adoxa Moschatellina** L.

Between Lesser Slave L. and Peace R. Landing, *J. M. Macoun*, no. 59874 (G, N, O); Lesser Slave L. district, *Brinkman*, nos. 4405, 4148 (N).

#### VALERIANACEAE

**Valeriana septentrionalis** Rydb.

Semi-open prairie N. of Hudson Hope, June 23, no. 3675. In flower. — N. of Dunvegan, *J. M. Macoun*, nos. 59973 (N), 59977 (O); Lesser Slave L. district, *Brinkman*, no. 4251 (N); near Halfway R., alt. 2600 ft., *Mrs. Henry*, no. 232 (P).

**Valeriana sitchensis** Bong.

Damp gullies on W. slope of Mt. Selwyn, alt. about 4000 ft., July 23, no. 4042, and July 26, no. 4179. In flower. — Mt. McCusker, alt. 5500 ft., *Mrs. Henry*, no. 318 (P).

#### CAMPANULACEAE

**Campanula uniflora** L.

West slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3933. In flower and immature fruit. — Mountain top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 59 (P).

**Campanula lasiocarpa** Cham.

West slope of Mt. Selwyn, alt. about 6000 ft., July 23, no. 4047. In flower. — Near Halfway R., alt. 4000 ft., *Mrs. Henry*, no. 18 (P).

**Campanula rotundifolia L.**

Gravel and sand bar along Peace R. at mouth of the Wicked R., July 16, no. 3846. In flower. — Near Halfway R., alt. 1800 ft., *Mrs. Henry*, no. 190 (P).

**Campanula rotundifolia L. var. *alaskana* Gray.**

Toad R., alt. 4200 ft., *Mrs. Henry*, no. 118 (P); near St. Paul's L., alt. 4000 ft., *Mrs. Henry*, no. 108 (P).

## COMPOSITAE

**Grindelia squarrosa** (Pursh) Dunal.

Dunvegan, *J. M. Macoun*, no. 61236 (O).

**CHRYSONOPSIS VILLOSA** Nutt.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Solidago multiradiata** Ait.

West slope of Mt. Selwyn alt. about 5000 ft., July 26, nos. 4078, 4101; damp sandy bank of Wicked R. near the Peace R., July 30, no. 4229. In flower. — Upper Liard R., *Dawson*, no. 9995 (O); base of Mt. McCusker, alt. 5000 ft., *Mrs. Henry*, no. 316 (P).

**Solidago decumbens** Greene.

Sandy and gravelly shores at mouth of Wicked R., July 16, no. 3858, and July 31, no. 4251. In flower. — Lesser Slave L. district, *Brinkman*, no. 4059 (C); near Halfway R., alt. 2400 ft. *Mrs. Henry*, no. 202 (P); Caribou Pass, alt. 5500 ft., *Mrs. Henry*, no. 285 (P).

**Solidago oreophila** Rydb.

Lesser Slave L. district, *Brinkman*, no. 4511 (C); Henry R., alt. 2300 ft., *Mrs. Henry*, no. 84 (P).

**Solidago missouriensis** Nutt. var. **montana** Gray.

Dunvegan, *J. M. Macoun*, no. 61237 (O).

**Solidago canadensis** L.

Cabin clearing at mouth of Wicked R., July 31, no. 4253; bank of Peace R. about 10 mi. above Carcasson Settlement, Aug. 15, no. 4350. In flower; the later ones with maturing fruit. — Dunvegan, *J. M. Macoun*, no. 61238 (N, O); Lesser Slave L. district, *Brinkman*, nos. 4601, 4484 (C).

*Solidago canadensis* is here interpreted in a broad sense to include the northwestern forms, as has been common practice among many botanists. If the material is to be further separated,

and Fernald's treatment followed, in which the northern and northwestern forms are considered as varieties of the Alaskan *S. lepida* DC. (Rhod. xvii. 8—10), the above numbers should probably be disposed of as follows: *S. lepida* var. *elongata* (Nutt.) Fern., no. 4350; *S. lepida* var. *fallax* Fern., no. 4253. The Macoun specimen would be var. *fallax*, and those of Brinkman var. *elongata*.

**SOLIDAGO SEROTINA** Ait.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**SOLIDAGO RIGIDA** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Solidago graminifolia** (L.) Salisb. var. **camporum** (Greene)

Fern. — *Euthamia camporum* Greene. — See Rhod. xvii. 12 (1915).

Lesser Slave L. district, *Brinkman*, no. 4508 (C).

**Aster Richardsonii** Spreng.

West slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4154; gravelly shore at mouth of Wicked R., July 16, no. 3856. In flower. — Between Frances L. and Pelly R., lat. 61°, *Dawson*, no. 7954 (O); near Taylor Flat, *Moss*, no. 2370 (G); Keeley Cr., alt. 4000 ft., *Mrs. Henry*, no. 54 (P); bank of Peace R., alt. 1800 ft., *Mrs. Henry*, no. 158 (P); junction of Halfway and Graham R.'s, alt. 1900 ft., *Mrs. Henry*, no. 210 (P).

*Aster Richardsonii* Spreng. was based upon *A. montanus* of Richardson, the latter name being eliminated by an earlier *A. montanus* Nuttall of the southern Appalachians. Richardson's material consisted of plants collected by himself on the first Franklin Expedition (1819—22) in the lower Mackenzie region (See App. Franklin's First Journey, 32, 1823), and upon two specimens in Hb. Lambert from Siberia (Pallas). In the Gray Herbarium there are photographs of the Richardson specimens in the British Museum, together with notes to the effect that Richardson also had some Rocky Mountain material before him marked "Dr. R. M." (Drummond), but this is manifestly impossible because Drummond's material was not collected until Franklin's 2nd Expedition (1825—7).

These photographs, and duplicates of Richardson collections in the New York Botanical Garden Herbarium and the National Museum of Canada, together with specimens collected in recent years on Great Slave Lake and the upper Peace River region,

show what the writer considers to be a single species. There are considerable variations in the habit of the typical plant, from an unbranched form, up to a foot in height, to a smaller simple or fastigiate branched one with a few-flowered corymbiform inflorescence, the single heads terminating rather long peduncles. The involucres are characteristically of lanceolate to acuminate bracts (in age squarrose), with purple tips or upper portions, the dark color often supplying narrow margins and mid-veins to the whole bracts. The pedicels and involucres vary from short- to long-villous or floccose. Most of the material is of low stature (1—2 dm.), and either entirely unbranched or with from 1 to 6 heads.

The major variations from the above are two. A tall, very tomentose form with large deeply serrate leaves, and with single or very few heads has long been known as var. *giganteus* Hook. Fl. Bor.-Amer. II. 7 [A. *giganteus* (Hook.) Rydb. in Bull. N. Y. Bot. Gard. II. 184. — A. *montanus* Richards. var. *giganteus* (Hook.) T. & G., Fl. N. Amer. II. 107.—A. *sibiricus* L. var. *giganteus* (Hook.) Gray, Syn. Fl. I. 177]. It is a northwestern form, sometimes approaching the Asiatic A. *sibiricus*. A second variation appears in the central Rocky Mountains and has been described as A. *meritus* by Aven Nelson, Bot. Gaz. xxxvii. 268—9 (1904). The writer has before him two numbers cited by Nelson as typical (6610, 2334), and judging from these and from his description the plant is characterized by a taller stem (2—4 dm.), under surfaces of the leaves less pubescent than in A. *Richardsonii*, a much branched corymbose inflorescence with smaller, short-pedicelled heads. The involucral bracts are broadly linear, purplish as in A. *Richardsonii*, acute, and rather short villous except for the ciliate margins; they are erect in the immature heads of the typical plants at hand, but other Rocky Mountain material shows them squarrose in age. The manner of growth as described by Nelson indicates a much more densely tufted habit than that of the wide-spread subarctic type. In the latter the rootstocks are loosely matted, making rather open colonies, one to few stems rising together. Needless to say, there are many intergrading forms between these two variations and the type.

The status of these forms has been discussed by Nelson (l. c.) and by Rydberg (Bull. Torr. Bot. Club, xxxvii. 134—6). The latter maintained A. *Richardsonii* for those forms of the arctic

and subarctic regions which have very villous peduncles and involucres, thus following the description written by Richardson (l. c.) for his *A. montanus*, while he broadened the conception of *A. meritus*, with its large crowded inflorescence, to cover the less villous forms of the north. However, as stated above, Richardson's type material shows wide variation in the villosity of the peduncles and involucres, while both Nelson's cited typical material and his description do not admit the low, loosely-matted subarctic forms with simpler inflorescences. In view of the nature and greater abundance of the specimens at hand it seems best to the writer to maintain the whole as a single polymorphic species, and to that end the following combination is proposed: **Aster Richardsonii** Spreng. var. **meritus** (A. Nels.), comb. nov. — *A. meritus* A. Nels. in Bot. Gaz. xxxvii. 268—9 (1904).

**Aster conspicuus** Lindl.

Poplar woods on bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4372. In flower. — Near junction of Halfway and Graham R.'s, alt. 1900 ft., *Mrs. Henry*, no. 209 (P).

**Aster modestus** Lindl.

Lesser Slave L. district, *Brinkman*, no. 4406 (C).

**Aster Lindleyanus** T. & G.

Bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4371. In flower. — Dunvegan, *Dawson*, no. 7823 (O); Lesser Slave L. district, *Brinkman*, nos. 4648a (N), 4037, 3885 (C); Toad R., alt. 4200 ft., *Mrs. Henry*, no. 115 (P); 15 mi. W. of Hudson Hope, alt. 1800 ft., *Mrs. Henry*, no. 338 (P).

**Aster laevis** L. var. **Geyeri** Gray.

Dunvegan, *Dawson*, no. 26363 (O); Dunvegan, *J. M. Macoun*, no. 59984 (O); Lesser Slave L. district, *Brinkman*, no. 4060 (C).

**Aster ericoides** L. — See *Rhod.* xxviii. 65 (1926).

Dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4370. With flowers and immature fruit.

**ASTER SIMPLEX** T. & G. — possibly *A. PANICULATUS* Lam.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

Macoun's record of *A. TENUIFOLIUS* in the same region may also be *A. paniculatus*.

**Aster junceus** Ait.

Bank of Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4351. In flower. — Beaverlodge R., *Moss*, no. 2310

(G); Lesser Slave L. district, *Brinkman*, no. 3994 (C); bank of Musqua R., alt. 2600 ft., *Mrs. Henry*, no. 147 (P).

**ASTER PUNICEUS** L.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**ASTER DOUGLASHI** Lindl. var.

Lesser Slave L. district, *Brinkman*, 1929.

**Aster foliaceus** Lindl.

Cabin clearing at mouth of Quartz Cr., July 29, no. 4209. In flower. This material is referred to *A. foliaceus* somewhat doubtfully at present. Its leaves are more dentate and petiolate, and it may be referable to *A. fol.* var. *subpetiolatus* Fern., Rhod. xvii. 13—17 (1915), or to *A. amplius* Lindl., the latter a very little known species. — Lesser Slave L. district, *Brinkman*, no. 3916 (N); near Peace R. 18 mi. W. of Hudson Hope, alt. 1800 ft., *Mrs. Henry*, no. 340 (P).

**Erigeron acris** L. var. **asteroides** (Andrz.) DC. — *E. droebachensis* Muell. — See Rhod. xii. 225 (1910).

Cabin clearing and sandy bank of Peace R. at mouth of Quartz Cr., July 21, no. 4004, and July 29, no. 4210. In flower. — Dunvegan, *J. M. Macoun*, no. 61230 (N, O); Lesser Slave L. district, *Brinkman*, no. 4598 (C).

**Erigeron acris** L. var. **arcuans** Fern. — See Rhod. xxviii. 236 (1926).

Gravelly bank of Carbon R. about 4 mi. above the Peace R., Aug. 2, no. 4270a. In flower. — S. fork of Besa R., alt. 4000 ft., *Mrs. Henry*, no. 315 (P).

**Erigeron acris** L. var. **debilis** Gray. — See Rhod. xii. 225 (1910).

Ledges in the upper part of the timber on Mt. Selwyn, July 19, no. 3896; gravelly bank of Carbon R. about 4 mi. above the Peace R., Aug. 2, no. 4270. In flower.

**Erigeron lonchophyllum** Hook.

Whitecourt, *Moss*, no. 1345 (G); McLennan, *Moss*, no. 2394 (G); Halfway R. near Horseshoe Cr., alt. 2400 ft., *Mrs. Henry*, (P).

**Erigeron unalaschkensis** (DC.) Vierh.

Damp turf ledges and slopes on Mt. Selwyn, alt. 4—6000 ft., July 13, no. 3788; July 23, no. 4064; near small lake, July 26, no. 4087. Damp rock ledges along Wicked R., July 14, no. 3810. In flower. — Mt. of the Gods, alt. 6000 ft., *Mrs. Henry*, no. 170 (P); basin above Robb L., alt. 6200 ft., *Mrs. Henry*, no. 263 (P).

**Erigeron grandiflorus** Hook.

Mountain in Caribou Pass, alt. 6500 ft., *Mrs. Henry*, no. 614 (P) (1933).

**Erigeron aureus** Greene var. **acutifolius**, var. nov.

Plate VII. 2.

A forma typica foliis acutis, oblanceolatis, restricte dentatis differt.

*Erigeron aureus* was first described by Asa Gray as *Aplopappus Brandegei* (Syn. Fl. I. 132), and subsequently placed in *Erigeron* by Greene (Pittonia, II. 169) with the new name *aureus* since there was an earlier *E. Brandegei*. In most current descriptions of the species the leaves are designated as spatulate or rounded, with no special mention of the shape of the apex, but the material in the Gray Herbarium, consisting of 21 sheets and including the type, show the leaves to be quite rounded or very obtuse at the apex, with a suggestion of acuteness in one or two individuals. The material collected by Mrs. Henry agrees well with the species except that its leaves are conspicuously acute at the apex.

In peat, mountain near Redfern L., alt. 5500 ft., *Mrs. Henry*, Aug. 2, 1932, no. 306 (P).

**Erigeron compositus** Pursh var. **trifidus** (Hook.) Gray.

Dry rock crevices on N. W. slope of Mt. Selwyn, alt. about 4000 ft., July 19, no. 3897. With maturing fruit. This material is clearly referable to the arctic, scapose form of the species. For recent revision and comment see the following: Contrib. Gray Herb. XLIX. 72—9 (1917); Univ. Wyo. Pub. Bot. I. 172—186 (1926); Rhod. XXX. 122—3 footnote (1928).

**Erigeron salsuginosus** (Richards.) Gray.

Rich thickets at or near timber line on Mt. Selwyn, alt. 4—5000 ft. July 13, no. 3789; July 19, no. 3975; July 26, nos. 4071, 4172. In flower. — Upper Halfway R., alt. 4000 ft., *Mrs. Henry*, no. 247 (P); head of Sukunka R., *Sheldon and Borden*.

**Erigeron glabellus** Nutt.

Sandy bank of Peace R. near mouth of the Wicked R., July 16, no. 3855; sandy bank of the Peace R., near mouth of Quartz Cr., July 21, no. 4003; in damp sand and mud deposits along Peace R. at the head of the Rocky Mt. Canyon, July 7, nos. 3734, 3735; grazed meadow N. of Hudson Hope, June 23, no. 3671. The last has very young inflorescences; the others are in flower. — Peace

R. Landing, *J. M. Macoun*, no. 61233 (N, O); Little Burnt R., *J. M. Macoun*, no. 61234 (G, N, O); Taylor Flat, *Moss*, no. 2346 (G); near Whitecourt, *Moss*, no. 1332 (G); bank of Peace R., alt. 1800 ft., *Mrs. Henry*, no. 152 (P); near junction of Peace and Halfway R.'s, alt. 2200 ft., *Mrs. Henry*, no. 181 (P); mountain side near L. Mary, alt. 4500 ft., *Mrs. Henry*, no. 143 (P); Pink Mt., alt. 4000 ft., *Mrs. Henry*, no. 234 (P).

Part of the specimens cited are referred here somewhat doubtfully, pending further study of the group.

***Erigeron philadelphicus* L.**

Dunvegan, *J. M. Macoun*, no. 61231 (N, O).

***Erigeron caespitosus* Nutt.**

Dunvegan, *J. M. Macoun*, no. 61232 (O).

***Antennaria monocephala* DC.**

West slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3969; near small lake on W. slope of Mt. Selwyn, alt. 5000 ft., July 26, no. 4134a. In flower. — Mountain N. of Redfern L., alt. 6000 ft., *Mrs. Henry*, nos. 310, 311 (P); basin above Robb L., alt. 6000 ft., *Mrs. Henry*, no. 266 (P).

The above specimens have been placed in this species somewhat tentatively, particularly since all of the Gray Herbarium material of it is away on loan at the time of writing.

***Antennaria atriceps* Fernald, sp. nov. Plate VIII. 2.**

Herba humifusa, stragula 0.5—1 dm. diametro formans, stolonibus foliosis ad 4.5 cm. longis. Folia basilaria oblanceolata vel anguste cuneato-spathulata, utrinque sericeo-tomentulosa, 0.5—1.5 cm. longa et 2—3.5 mm. lata, apice valde mucronata mucronibus 0.5—1 mm. longis saepe unguiculatis. Caulis floriferus 0.5—1 dm. altus. Folia caulina 7—11; ima oblanceolata, obtusa, mucronata; media superioraque linearia, 1—1.7 cm. longa, apice scarioso oblongo 2—3 mm. longo munita. Capituli feminei 1—5 corymbosi. Involucrum turbinato-cylindricum, 8—10 mm. altum, basi viridescens plus minusve lanatum; bracteae 3-seriatae, atro-fuscae, tenuissimae, exteiiores oblongae, acutae, interiores oblongo-lanceolatae, apice acuminatae vel subaristatae, 0.8—1.3 mm. latae. Corolla 5 mm. longa, apice purpurascens. Stylus valde exsertus, flavescens dein brunneus. Pappus 5.5—6.3 mm. longus. Achaenia 1.4 mm. longa, glabra. Planta mascula ignota.

Near small lake on W. slope of Mt. Selwyn, alt. 5000 ft., July 26, no. 4134 (Type).

In its conspicuously mucronate basal leaves *Antennaria atriceps* clearly belongs in the group of *A. alpina* (L.) Gaertn. From the typical Old World *A. alpina*, which does not seem to occur in America, it differs in its tomentulose basal leaves, in most of its caudine leaves terminating in scarious and oblong appendages, and in the long, almost black, involucre. European *A. alpina* has the rosette-leaves glabrous or promptly glabrate and green above, the lower and median caudine leaves mucronate, only the uppermost scarious-tipped, and the shorter involucre brown, rather than blackish.

Of the North American representatives of *A. alpina* the one most closely approaching *A. atriceps* in size of head is *A. angustata* Greene, of Labrador, Baffin Island and Greenland. *A. angustata*, however, is densely cespitose rather than humifuse, the closely crowded basal offshoots ascending and not prolonged and stoloniform; its basal leaves are soon glabrate and green above and they taper gradually to the short mucro; its caudine leaves are fewer and narrower; its heads are mostly solitary (the inflorescences in the Gray Herbarium showing 131 with 1 head, 21 with 2 or 3); its involucre of more nearly equal bracts and densely lanate at base; the style included or only barely exserted.

***Antennaria megacephala* Fernald, sp. nov.** Plate IX.

Herba humifusa, stragula 2—5 cm. diametro formans, stolonibus foliosis brevibus. Folia basilaria oblongo-ovata supra canescens-pannosa dein glabrata, 6—8 mm. longa et 3—4 mm. lata, apice callosa vel breviter mucronata, mucronibus 0.1—0.3 mm. longis. Caulis floriferus 4.5—8 cm. altus. Folia caulina 8—10; ima oblanceolata apice rotundata valde mucronata; media superioraque linear-lanceolata, apice scarioso 3.5—4 mm. longa munita. Capitulum femineum solitarium. Involucrum hemisphericum, 7—10 mm. altum et 1.5—1.7 cm. latum, basi brunnescens lanatumque; bracteae 4—5-seriatae, viridi-fuscae, tenuissimae, subaequales, oblongae, exteriores 2 mm. latae, subacute, interiores 1.5 mm. latae, acuminatae. Corolla 4—4.6 mm. longa, apice purpurascens. Stylus exsertus. Pappus 6—7 mm. longus. Achaenia (immatura) 1.4 mm. longa, glabra. Planta mascula ignota.

Stone slide in sun, mountain near Mt. Kenny, alt. 5800 ft.,

July 27, 1932, *Mrs. Henry*, no. 286 (P). A fragment of the type is in the Gray Herbarium.

*Antennaria megacephala* superficially somewhat suggests *A. glabrata* (J. Vahl) Greene, of Greenland. That species, however, is cespitose, with elongate oblanceolate basal leaves quite glabrous and lustrous-green from the first and tapering to a long mucro; its caudine leaves are likewise glabrous or promptly glabrate; and its involucres are essentially glabrous at base.

In its large solitary head *Antennaria megacephala* superficially simulates *A. angustata* Greene, but the resemblance is wholly superficial, for *A. angustata*, like *A. glabrata*, is cespitose, without decumbent stolons, its elongate basal leaves taper gradually to the mucro, and its involucre consists of subequal and very attenuate bracts.

In its broad involucral bracts and solitary large head *Antennaria megacephala* might suggest *A. pygmaea* Fernald, of Labrador; but *A. pygmaea* has narrower rosette-leaves with long mucro, shorter (1.5—2 mm. long) and broader terminal appendages of the caudine leaves, and white and petaloid, strongly imbricated, involucral bracts.

**Antennaria isolepis** Greene.

Quartz ridge on N. W. slope of Mt. Selwyn, July 23, no. 4066a; near small lake on W. slope of Mt. Selwyn, alt. 5000 ft., July 26, no. 4134a.

This species has not been recorded previously west of the western shore of Hudson Bay.

**Antennaria cana** (Fern. & Wieg.) Fernald.

Mountain near Redfern L., alt. 5500 ft., *Mrs. Henry*, no. 309 (P).

This species has been known previously only as a Newfoundland endemic.

**Antennaria pulvinata** Greene.

West slope of Mt. Selwyn, alt. about 6000 ft. July 13, no. 3774. In flower.

**Antennaria umbrinella** Rydb.

West slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3930; sandy shore of Wicked R., near the Peace R., July 18, no. 3883. In flower.

**Antennaria rosea** (D. C. Eat.) Greene.

Damp sandy banks of Wicked R. near the Peace R., July 18,

no. 3887; high bluff S. of Peace R. opposite Hudson Hope, June 28, no. 3719. In flower. — Island Cr., N. of Dunvegan, *J. M. Macoun*, no. 61223 (G, N, O); Lesser Slave L. district, *Brinkman*, nos. 4392, 4575 (C).

**Antennaria nitida** Greene.

White Mud R., *J. M. Macoun*, no. 61224 (G, N, O).

**Antennaria Howellii** Greene.

West slope of Mt. Selwyn, alt. about 4000 ft., July 26, no. 4158; pine woods near Hudson Hope, June 26, no. 3610. In flower; and the latter with maturing achenes.

**Antennaria campestris** Greene.

Top of dry river bluff at Taylor Flat, June 12, no. 3569. In flower. — Peace R. Landing, *J. M. Macoun*, nos. 61226 (G, N, O), 61228 (G, N); Lesser Slave L., *J. M. Macoun*, no. 61227 (G, N).

**Antennaria parvifolia** Nutt.

Peace R. Landing, *J. M. Macoun*, nos. 61222, 61225 (N, O).

**Antennaria pulcherrima** (Hook.) Greene.

Along Rocky Mountain Portage road near Hudson Hope, Aug. 4, no. 4345. With maturing achenes. — Musqua R., alt. 2600 ft., *Mrs. Henry*, no. 148 (P); upper Halfway R., alt. 4000 ft., *Mrs. Henry*, no. 242 (P).

**Helianthus rigidus** Desf.

Dunvegan, *J. M. Macoun*, no. 61235 (N, O).

*HELIANTHUS STRUMOSUS* L. — possibly *H. GIGANTEUS* L. var. or *H. RIGIDUS* Desf.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Bidens cernua** L.

Lesser Slave L. district, *John Macoun*, no. 12054 (O), and *Brinkman*, no. 3872 (N).

**Achillea borealis** Bong.

Damp muddy-sandy bank of Peace R. near the mouth of the Wicked R., July 16, no. 3850. In flower.

**Achillea Millefolium** L.

Dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4364. In flower. — Near Lesser Slave L., *Moss*, no. 2218 (G); Notikewin, *Moss*, no. 2268 (G); Lesser Slave L. district, *Brinkman*, no. 4502 (C); above Cameron Cr., alt. 2200 ft., *Mrs. Henry*, no. 199 (P); near Peace R., alt. 1800 ft., *Mrs. Henry*, (P).

**Achillea sibirica** Ledeb. — *A. multiflora* Hook. — See Rhod. xxxi. 219 (1929).

Dunvegan, *Dawson*, no. 26298 (O).

**MATRICARIA MATRICARIOIDES** (Less.) Porter. — *M. suaveolens* (Pursh) Buch. — *M. discoidea* DC. — *Chamomilla suaveolens* (Pursh) Rydb. Hudson Hope, *John Macoun*, 1875 (noted as *M. discoidea*).

**Chrysanthemum integrifolium** Richards.

Mountain N. of St. Paul's L., alt. 5500 ft., *Mrs. Henry*, no. 129 (P).

**CHRYSANTHEMUM LEUCANTHEMUM** L.

Lesser Slave district, *Brinkman*, 1929.

**Artemisia canadensis** Michx.

Lesser Slave L. district, *Brinkman*, no. 4619 (C); Musqua R., alt. 2600 ft., *Mrs. Henry*, no. 80 (P); bank of Peace R., alt. 1800 ft., *Mrs. Henry*, no. 153 (P).

**Artemisia borealis** Pall. var. **Purshii** Bess.

West slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3953.

In flower.

**ARTEMISIA DRACUNCULOIDES** Pursh.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**ARTEMISIA BIENNIS** Willd.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Artemisia frigida** Willd.

Dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4383. In flower. — Mountain side near L. Mary, alt. 4400 ft., *Mrs. Henry*, no. 141 (P).

**Artemisia norvegica** Fries.

Damp turf slopes on Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3962; July 26, no. 4181. The first has very young inflorescences; the second is in flower. — Mountain top near Norman R., alt. 6000 ft., *Mrs. Henry*, no. 95 (P).

Rydberg treated Rocky Mountain material in this species complex as distinct from the European, naming it *A. saxicola*, Bull. Torr. Bot. Club, xxxii. 128—9 (1905). The Mt. Selwyn and Norman R. specimens, however, match very well with European ones in the Gray Herbarium as to the form of the inflorescence and the shape of the leaves, characters used by Rydberg in making the separation. There is a tendency toward longer leaves in some Rocky Mountain material.

**Artemisia Tilesii** Ledeb.

Gravelly bank of Peace R. at Taylor Flat, Aug. 8, no. 4393;

dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4359. In flower. — Frances L., lat. 61°, Dawson, (O).

Rydberg distinguished most American material as *A. elatior* (*A. Tilesii* var. *elatior* T. & G.), Mem. N. Y. Bot. Gard. 1. 430 (1900), stating that the latter has "rather large nodding heads in an ample panicle", while *Tilesii* has "rather few large heads in a glomerate inflorescence". The writer has seen nearly all of the available Mackenzie basin specimens, and is inclined at present to maintain them as *A. Tilesii* since they include both forms without adequate geographic separation. The species is excessively variable, however, and further collections may justify the segregation.

**ARTEMISIA LUDOVICIANA** Nutt.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872.

**Artemisia discolor** Dougl.

Rock crevices on W. slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3946; gravelly shore of Carbon R. about 4 mi. above the Peace, Aug. 2, no. 4273. In flower; the last with immature fruit.

**Petasites nivalis** Greene.

Pass N. E. of Robb L., alt. 5800 ft., *Mrs. Henry*, no. 348 (P).

**Petasites palmatus** (Ait.) Gray.

Cabin clearing at mouth of Quartz Cr., July 21, no. 4005; mossy-sandy bank of Wicked R. near the Peace R., July 30, no. 4239; woods in ravine on high bluff N. W. of Hudson Hope, June 27, no. 3688. In fruit. — Lesser Slave L. district, *Brinkman*, no. 4130 (C); W. of Dawson Cr., *Moss*, no. 2340 (G); Aylard summit, alt. 3300 ft., *Mrs. Henry*, no. 331 (P).

**Petasites vitifolius** Greene.

Lesser Slave L. district, *Brinkman*, no. 4524 (C); near Ft. St. John, *Moss*, no. 2355 (G).

**Petasites sagittatus** (Pursh) Gray.

Slough along Rocky Mt. Portage road near Hudson Hope, Aug. 6, no. 4335. Leaves only. — Lesser Slave L. district, *Brinkman*, no. 4145 (C).

**Arnica cordifolia** Hook.

Turfy slopes of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3949; rich woods along Wicked R. near the Peace R., July 18, no. 3876;

spruce-poplar woods near upper end of Rocky Mt. Canyon, July 7, no. 3747; poplar woods S. of the Peace R. opposite Hudson Hope, June 28, no. 3713; pine woods on river bluff at Hudson Hope, June 20, no. 3622. All with flowers; the last two with maturing fruit. — North of Dunvegan, *J. M. Macoun*, no. 59981 (O).

**Arnica chionopappa** Fern.

West slope of Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3966; open woods along Wicked R. near the Peace R., July 18, no. 3869. In flower; the latter with maturing achenes. — Old Wives L., N. of Peace R., *J. M. Macoun*, no. 59983 (G, N, O). Hitherto considered a species of N. E. America.

**Arnica latifolia** Bong.

Thickets about timber line on Mt. Selwyn, alt. about 4000 ft., July 26, nos. 4155, 4164. In flower. — Head of Sukunka R., *Sheldon and Borden*.

**ARNICA AMPLEXICAULIS** Nutt.

Pine R., *Dawson*, 1879.

**Arnica rhizomata** A. Nels.

Dunvegan, *J. M. Macoun*, no. 59982 (O).

**ARNICA FOLIOSA** Nutt.

Coal Brook, near lower forks of Pine R., *Dawson*, 1879.

**Arnica Parryi** Gray.

Mountain above Redfern L., alt. 5000 ft., *Mrs. Henry*, no. 297 (P).

**Arnica alpina** (L.) Olin.

Mountain top, Caribou Range, alt. 6500 ft., *Mrs. Henry*, no. 69 (P).

**Arnica tomentosa** J. M. Macoun.

Turfy slopes on Mt. Selwyn, alt. 4—5000 ft., July 19, no. 3939. In flower.

**Arnica obtusifolia** Less. var. **acuta**, var. nov. Plate VIII. 1.

Folia apice acuta, oblonga vel spathulata, dentibus salientibus restricte dentata.

Leaves acute at the apex, oblong or spatulate, sparingly dentate with salient teeth.

In moist peat, pass N. E. of Robb L., alt. 5500 ft., *Mrs. Henry*, July 26, 1932, no. 279 (P).

With its scapose habit and its large radiate head conspicuously

nodding in anthesis, this plant is closely allied to *A. obtusifolia* Lessing (*Linnaea*, vi. 236, 1831), and quite distinct from other American species. All descriptions of *obtusifolia*, however, as well as the few specimens in the Gray Herbarium, indicate that obtuse leaves are the rule, while Mrs. Henry's specimens have conspicuously acute ones.

**Senecio eremophilus** Richards.

Dunvegan, *Dawson*, (O).

**Senecio triangularis** Hook.

Damp thickets on W. slope of Mt. Selwyn, alt. about 4000 ft., July 23, no. 4049, and July 26, no. 4171. In flower. — South of Lesser Slave L., *John Macoun*, no. 14879 (O).

**Senecio lugens** Richards.

Damp thickets and crevices on Mt. Selwyn, alt. 3—6000 ft., July 13, nos. 3765, 3794; July 19, no. 3900. Rich woods along Wicked R., July 14, no. 3808. In flower. — Upper Liard R., lat. 60°, *Dawson*, no. 16581 (O); hills near Finlayson L., lat. 60°, and Frances R., lat. 61°, *Dawson*, (O); head of Sukunka R., *Sheldon and Borden*.

**Senecio cymbalariaeoides** Nutt. var. **borealis** (T. & G.) Greenm. — See Ann. Mo. Bot. Gard. III. 177 (1916).

Crevices and stony slopes of Mt. Selwyn, July 19, no. 3899, and alt. about 4000 ft., July 26, no. 4163; dry river bluff at Taylor Flat, June 12, no. 3547. In flower. — Dease R., lat. 59°, *Dawson*, no. 14775 (O); Peace R. Landing, *J. M. Macoun*, no. 61239 (G, O).

**Senecio indecorus** Greene. — See Rhod. xxvi. 120 (1924).

Sandy bank of Peace R. at mouth of Quartz Cr., July 21, no. 3999; gravelly bank of Carbon R. about 4 miles above the Peace R., Aug. 2, no. 4274. In flower; the latter with maturing achenes.

Lesser Slave L. district, *Brinkman*, no. 4408 (C); Robb L., alt. 4000 ft., *Mrs. Henry*, no. 248 (P).

**Senecio pauperculus** Michx. — See Rhod. xxiii. 299 (1921).

Sandy and gravelly shores of Peace R. near the mouths of Wicked R. and Quartz Cr., July 16, no. 3853; July 29, no. 4208; July 31, no. 4255; high bluff N. of Hudson Hope, June 23, no. 3670; springy river bank at Hudson Hope, June 22, no. 3653. All in flower; no. 4255 with maturing achenes also. — Lesser Slave L. district, *Brinkman*, no. 4336 (C); Henry R., alt. 2300 ft.,

*Mrs. Henry*, no. 85 (P); Peace R., alt. 1800 ft., *Mrs. Henry*, (P); upper Halfway R., alt. 2600 ft., *Mrs. Henry*, no. 233 (P); above Cameron Cr., *Mrs. Henry*, no. 198 (P).

**Cirsium Drummondii** T. & G.

North of Caribou Pass, alt. 4500 ft., *Mrs. Henry*, no. 321 (P). This material is young, and therefore somewhat doubtfully determined.

**Crepis elegans** Hook.

Halfway R., alt. 3200 ft., *Mrs. Henry*, no. 241 (P).

**Crepis nana** Richards.

Upper Halfway R., alt. 4000 ft., *Mrs. Henry*, no. 251 (P).

**Hieracium canadense** Michx.

Cabin clearing at mouth of Wicked R., July 26, no. 4190, and July 31, no. 4257. In flower. — Dunvegan, *Dawson*, no. 15043 (O).

**Hieracium gracile** Hook.

Thickets near timber line on Mt. Selwyn, alt. about 4000 ft., July 19, no. 3898, and July 26, no. 4191. In flower. — Near McLeod L., *John Macoun*, no. 39381 (O); Mt. McCusker, alt. 5500 ft., *Mrs. Henry*, no. 317 (P).

**Hieracium albiflorum** Hook.

Thickets in upper part of timber on Mt. Selwyn, alt. about 4000 ft., July 23, no. 4060, and July 26, no. 4150. In flower and immature fruit.

**Taraxacum ceratophorum** (Ledeb.) DC. — See Rhod. xxxv. 369—86 (1933) for a treatment of this and the following species of *Taraxacum*.

Open woods and muddy banks along Wicked R. near the Peace R., July 16, no. 3843, and July 18, no. 3886. In flower. — Island Cr., N. of Peace R., *J. M. Macoun*, no. 61242 (O).

**Taraxacum dumetorum** Greene.

Semi-open prairie N. of Hudson Hope, June 23, no. 3673. In flower and fruit.

**Taraxacum lacerum** Greene.

Dry rock crevices on N. W. slope of Mt. Selwyn, alt. about 4000 ft., July 19, no. 3987; cabin clearing at mouth of Wicked R., July 31, no. 4258. With flowers and fruit. — Upper Liard R., lat. 60°, *Dawson*, no. 15119 (O).

**Taraxacum lyratum** (Ledeb.) DC.

West and northwest slopes of Mt. Selwyn, alt. 4500—5500 ft., July 23, no. 4053, and near small lake, July 26, no. 4111. With flowers and immature achenes. — Mountain N. of Redfern L., alt. 5500 ft., *Mrs. Henry*, no. 302 (P).

**Taraxacum lapponicum** Kihlm.

West slope of Mt. Selwyn, alt. 4—5000 ft., July 26, nos. 4079, 4149. In flower.

**Lactuca pulchella** (Pursh) DC.

Dry bluff along Peace R. about 10 mi. above Carcajou Settlement, Aug. 15, no. 4363. With flowers and immature fruit. — Near Halfway R., N. of Bear Flats, alt. 2000 ft., *Mrs. Henry*, (P).

*PRENANTHES RACEMOSA* Michx. — *Nabalus racemosus* (Michx.) Hook.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872 (noted as *Nabalus racemosus*).

**Agoseris gaspensis** Fern.

Thickets on W. slope of Mt. Selwyn near timber line, alt. about 4000 ft., July 26, no. 4174. With flowers and maturing fruit. Previously known only as a Gulf of St. Lawrence endemic.

**Agoseris glauca** (Pursh) D. Dietr. var. **scorzoneraefolia** (Schrad.) Piper.

West of McLeod L., *John Macoun*, no. 15084 (O); Old Wives L., *J. M. Macoun*, no. 61242 (N, O); Peace R. Landing, *J. M. Macoun*, no. 61241 (N, O); upper Halfway R., alt. 3500 ft., *Mrs. Henry*, no. 252 (P); base of Mt. McCusker, alt. 5000 ft., *Mrs. Henry*, (P).

*AGOSERIS CUSPIDATA* (Pursh) D. Dietr. — *Troximon cuspidatum* Pursh.

*Nothocalais cuspidata* (Pursh) Greene — possibly *Agoseris glauca* or a var. of it.

Between Lesser Slave L. and Hudson Hope, *John Macoun*, 1872 (noted as *Troximon cuspidatum*).

## SUMMARY OF PLANTS TREATED IN THIS CATALOGUE

	Families.	Genera.	Species.	Vars. and forms.	Total number of different plants.*
Pteridophyta	5	14	38	9	42
Gymnospermae	1	6	11	2	11
Monocotyledoneae	13	67	198	30	205
Archichlamydeae	35	106	298	41	312
Metachlamydeae	20	85	209	29	214
<b>Totals</b>	<b>74</b>	<b>278</b>	<b>754</b>	<b>111</b>	<b>784</b>

\*There are 81 species which are represented only by one or more varieties or forms. The figures for the total number of different plants are obtained by subtracting these species from the total numbers of species, varieties, or forms.

## EXPLANATION OF THE PLATES

## PLATE I

Fig. 1. Mt. Selwyn, seen from the north bank of the Peace River near the mouth of the Wicked River.  
 Fig. 2. Peace River valley a short distance east of Mt. Selwyn.

## PLATE II

Fig. 1. Summit of Mt. Selwyn, looking southward. July 13.  
 Fig. 2. Valley of the Peace River just east of the Rocky Mountain Canyon. The high mountains in the distance (with snow) are parts of the main range. The nearer elevation at the left of the picture is Bullhead Mountain, while its continuation on the right is the Butler Ridge. The pictures were taken on the high bluff on the south side of the valley, with Maurice Creek in the foreground and the town of Hudson Hope on the bank of the river at the right.

## PLATE III

Fig. 1. Grassy bluffs on the north bank of the Peace River a short distance below Dunvegan.  
 Fig. 2. The Peace River at Vermilion Chutes. The elevation in the distance is the Caribou Mountain plateau.

## PLATE IV

*Salix polaris* Wahl. var. *selwynensis*, var. nov. (Habit  $\times \frac{3}{4}$ , male and female aments  $\times 3$ ). The male ament is from no. 4123.

## PLATE V

*Salix fallax*, sp. nov. (Habit  $\times \frac{3}{4}$ , female ament  $\times 3$ ).

## PLATE VI

Fig. 1. *Arenaria Rossii* Richards. var. *columbiana*, var. nov. (Habit  $\times \frac{3}{4}$ , flowers  $\times 3$ ).  
 Fig. 2. *Draba longipes*, sp. nov. (Habit  $\times \frac{3}{4}$ , detail of basal leaf  $\times 3$ ).

## PLATE VII

Fig. 1. *Braya Henryae*, sp. nov. (Habit  $\times \frac{3}{4}$ , detail of inflorescence  $\times 3$ ).  
 Fig. 2. *Erigeron aureus* Greene var. *acutifolius*, var. nov. ( $\times \frac{3}{4}$ ).

## PLATE VIII

Fig. 1. *Arnica obtusifolia* Less. var. *acuta*, var. nov. ( $\times \frac{3}{4}$ ).  
 Fig. 2. *Antennaria atriceps* Fernald, sp. nov. (Habit  $\times \frac{3}{4}$ , detail of inflorescence  $\times 3$ ).

## PLATE IX

*Antennaria megacephala* Fernald, sp. nov. (Habit  $\times \frac{3}{4}$ , detail of heads  $\times 3$ ).

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Synonyms are printed in *italics*; new names in **bold-face** type; names of families in small CAPITALS.

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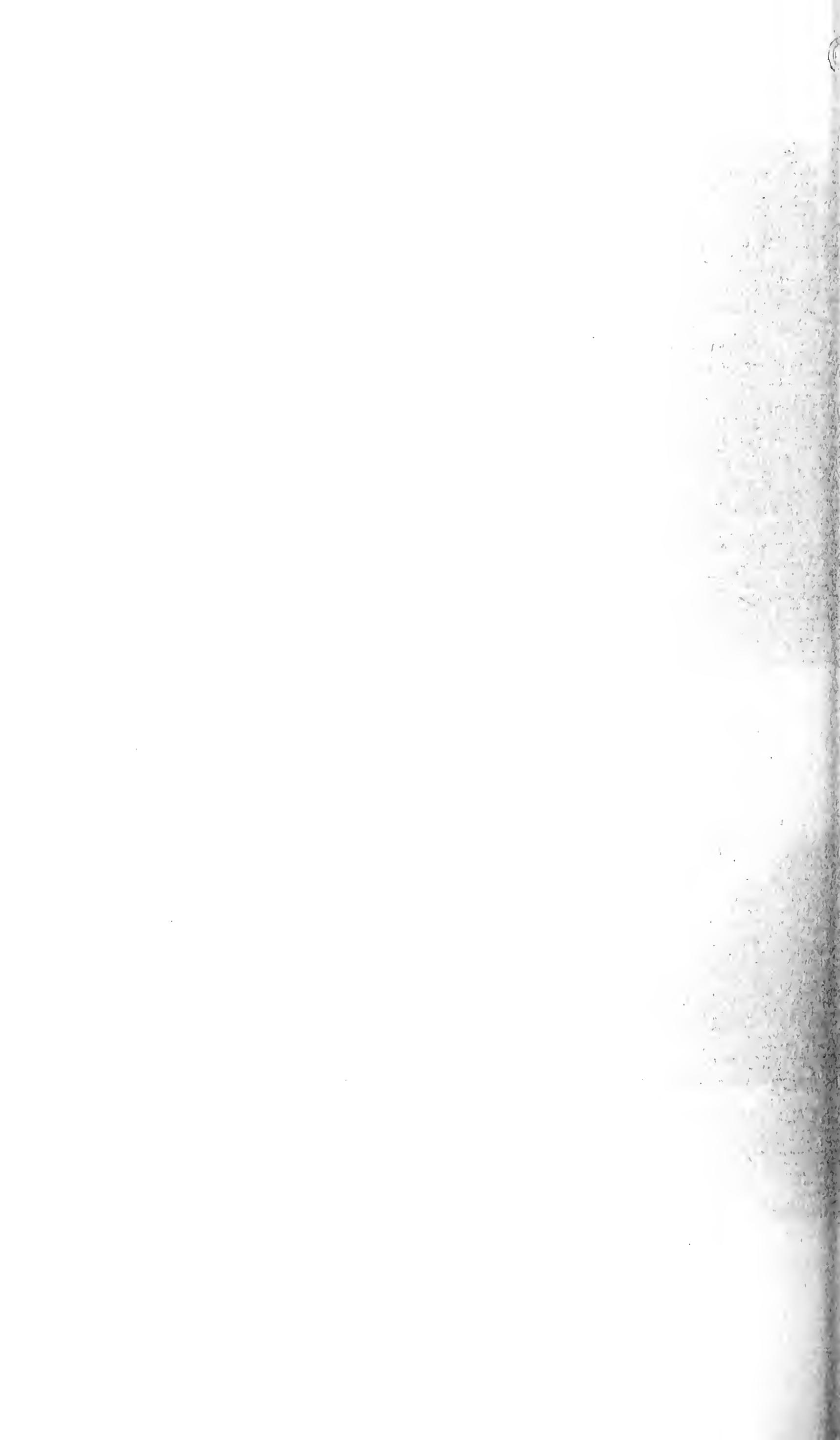
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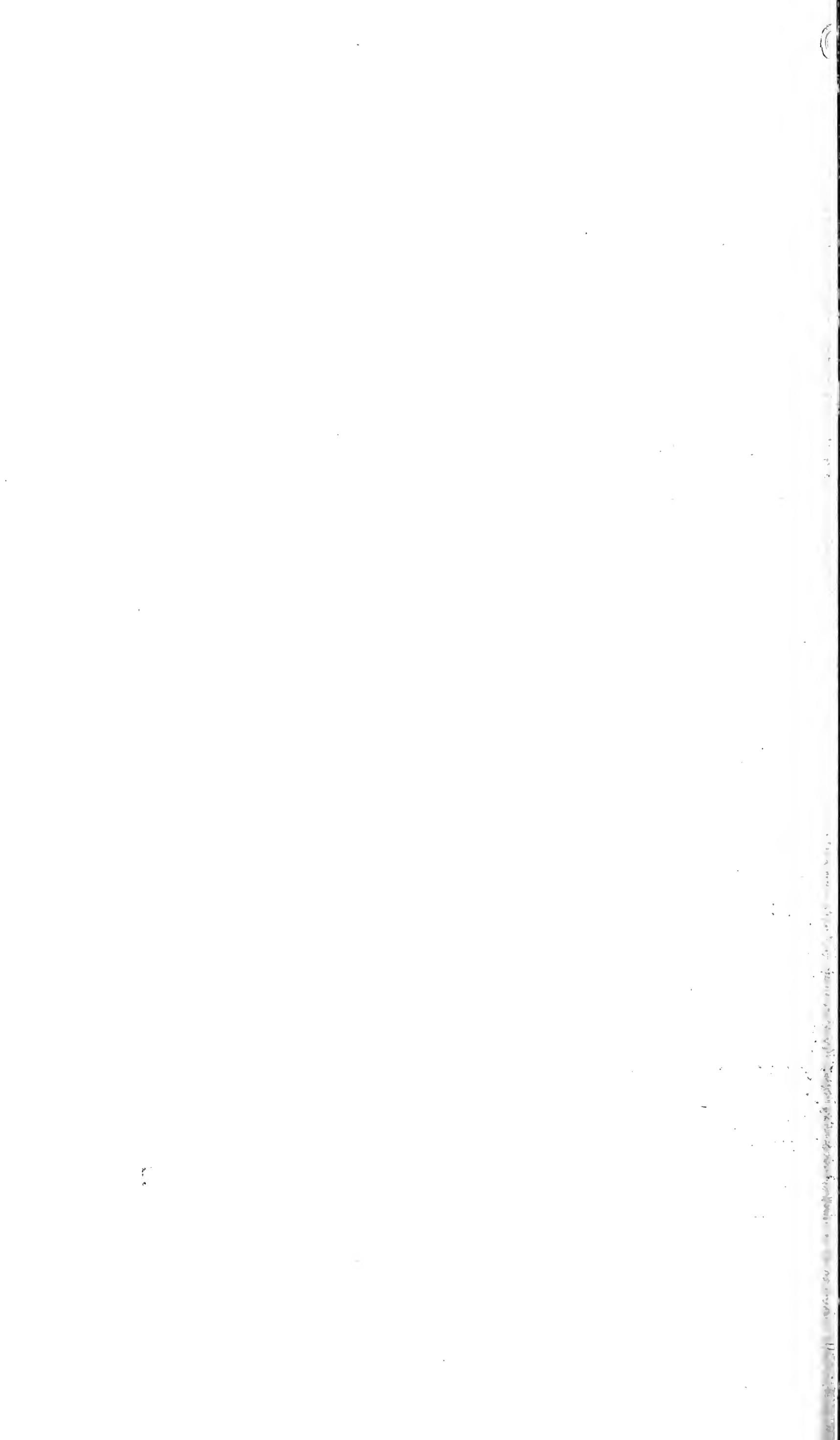


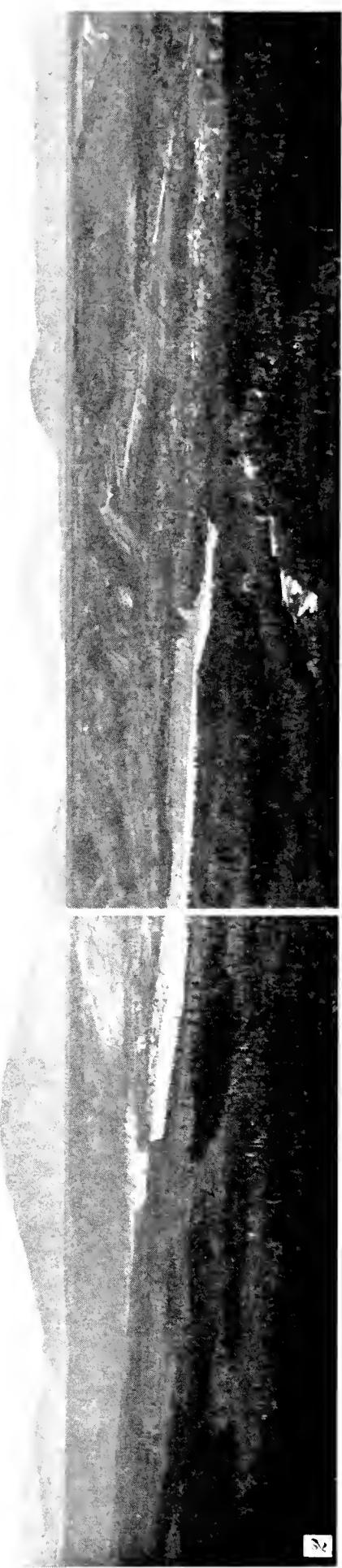
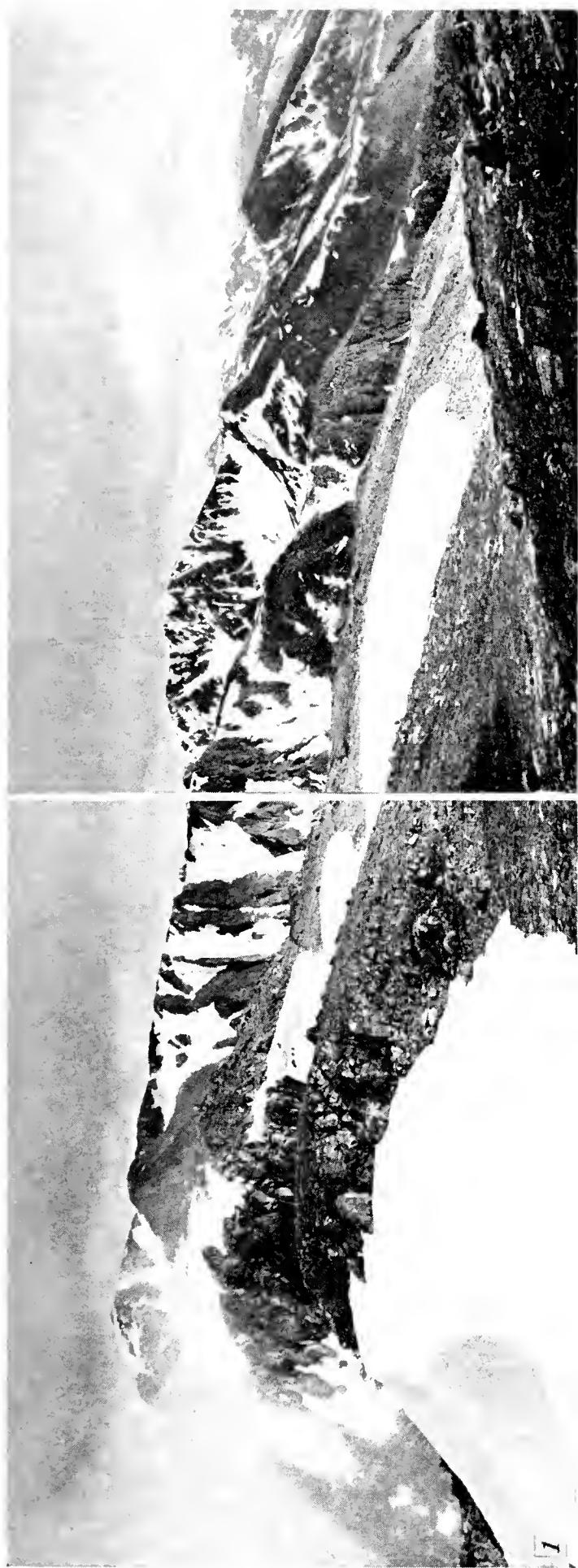
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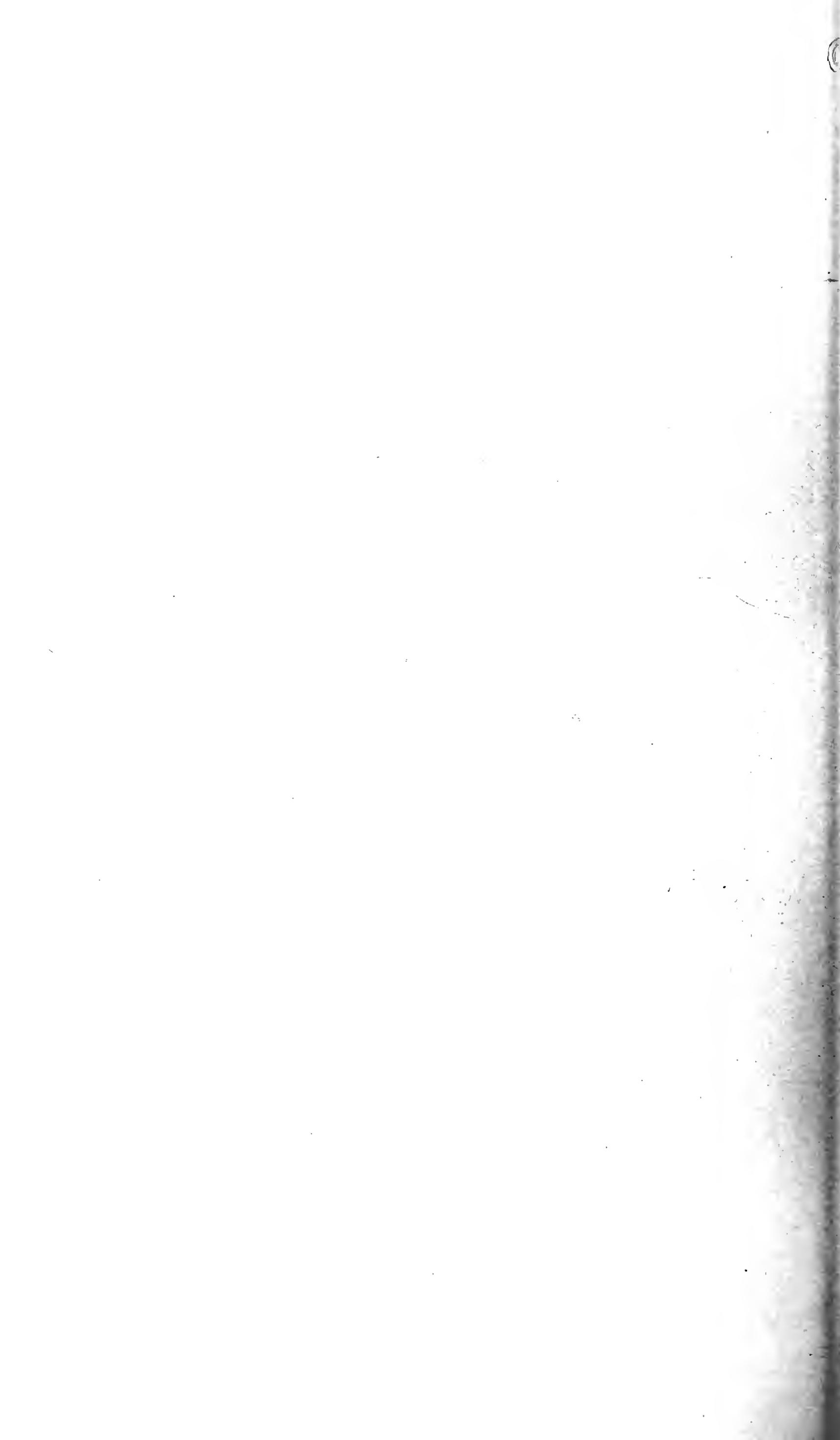
1. MT. SELWYN.
2. PEACE RIVER JUST EAST OF MT. SELWYN.





1. SUMMIT OF Mt. SELWYN.

2. VALLEY OF PEACE RIVER AT HUDSON HOPE.





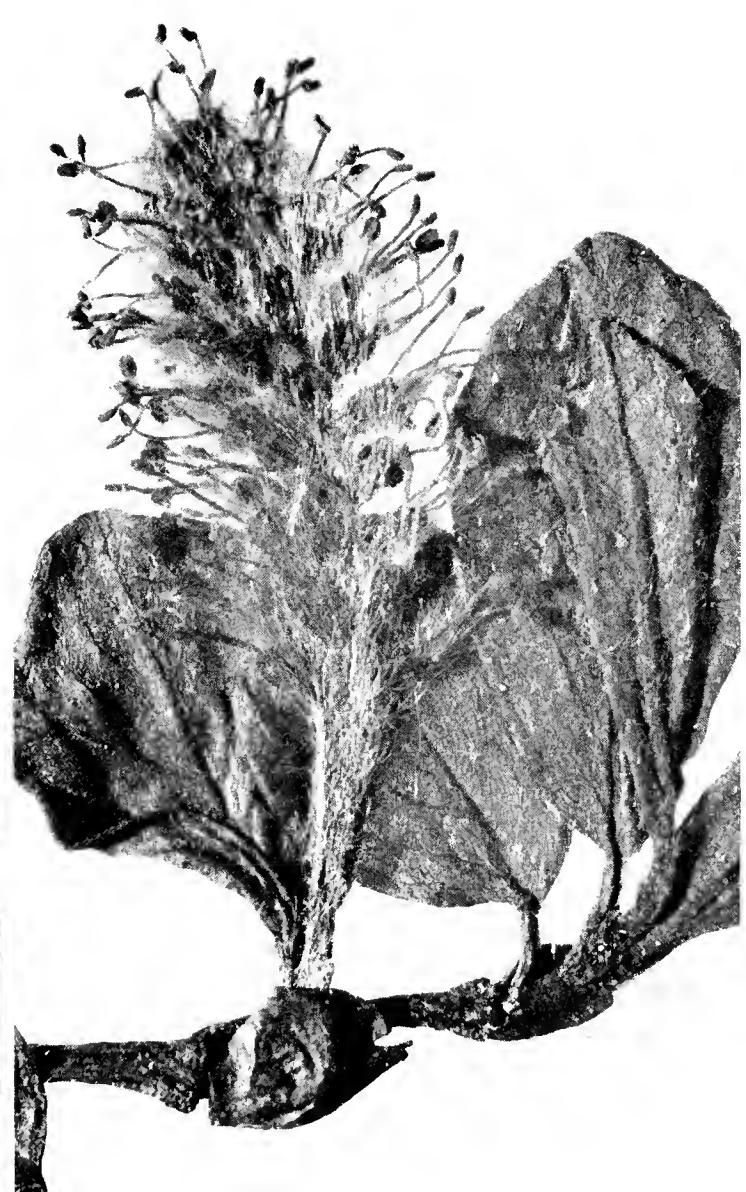
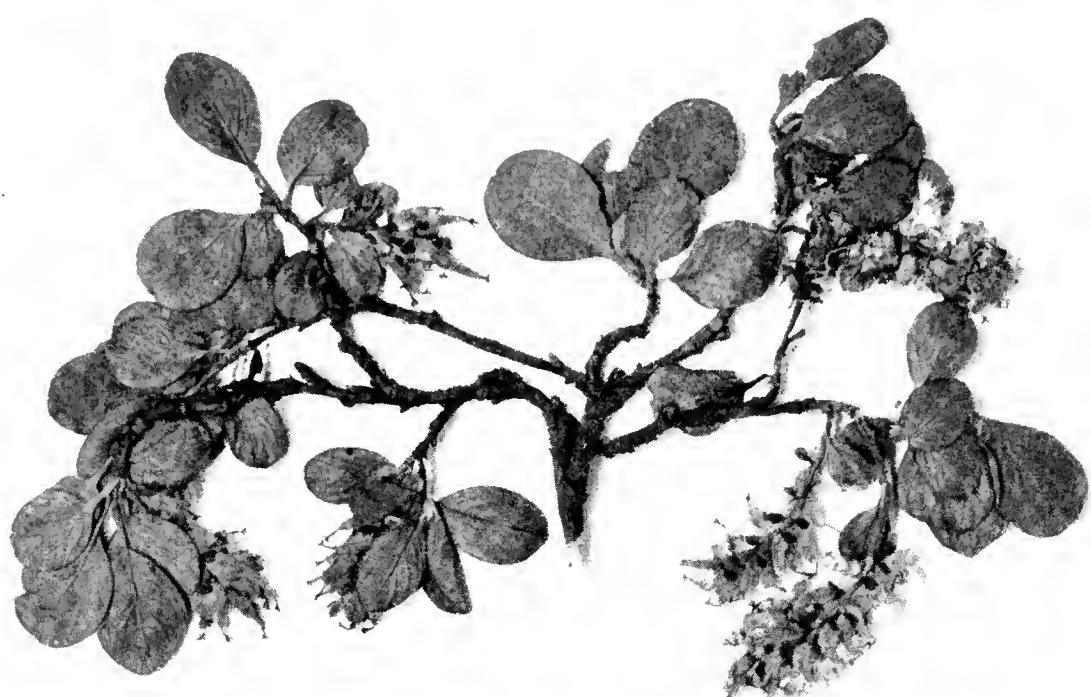
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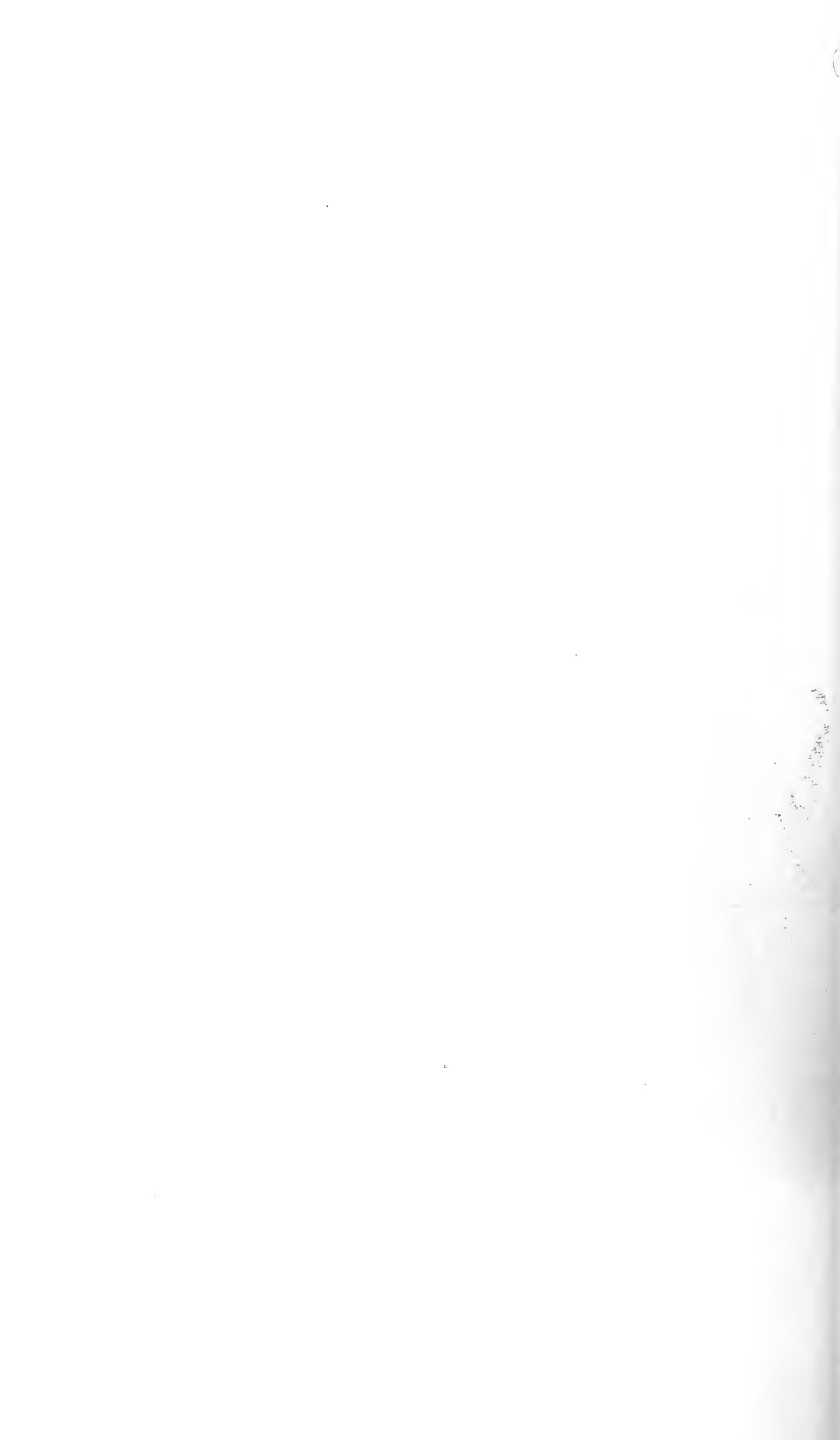
2

1. VALLEY SLOPE NEAR DUNVEGAN.
2. PEACE RIVER AT VERMILION CHUTES.





SALIX POLARIS var. SELWYNENSIS Raup.





SALIX FALLAX Raup.



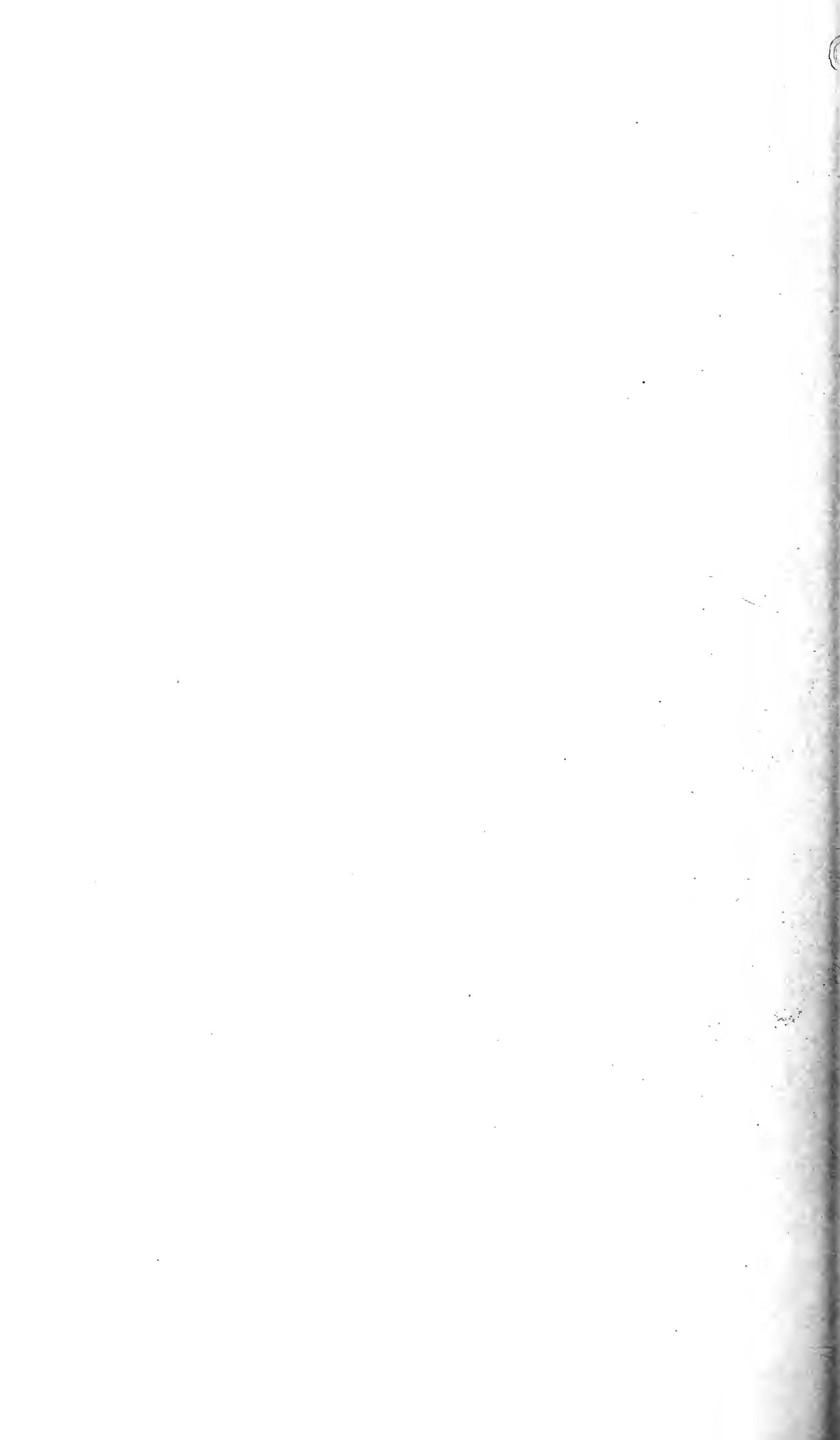


1. *ARENARIA ROSSII* var. *COLUMBIANA* Raup.  
2. *DRABA LONGIPES* Raup.





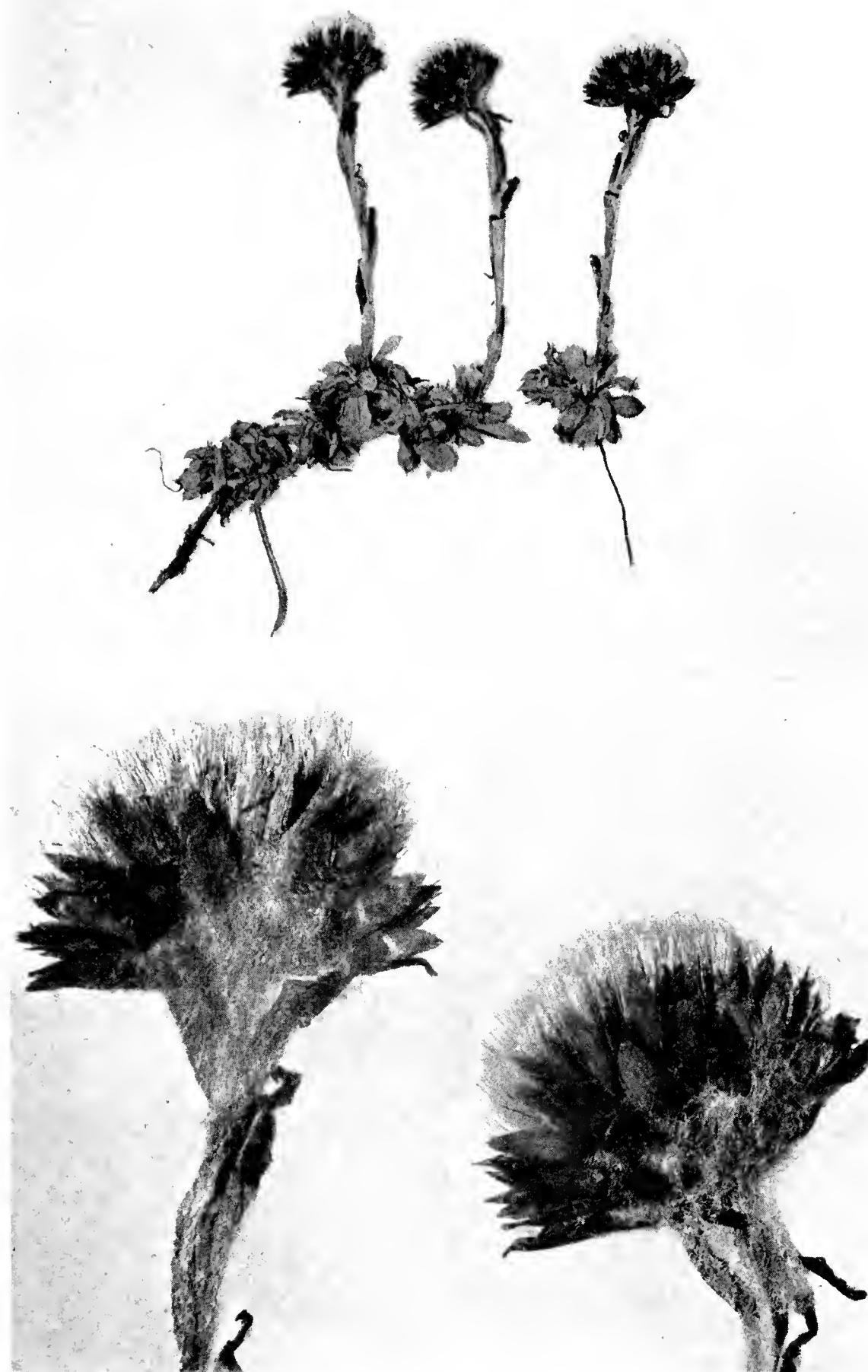
1. *BRAYA HENRYAE* Raup.
2. *ERIGERON AUREUS* var. *ACUTIFOLIUS* Raup.





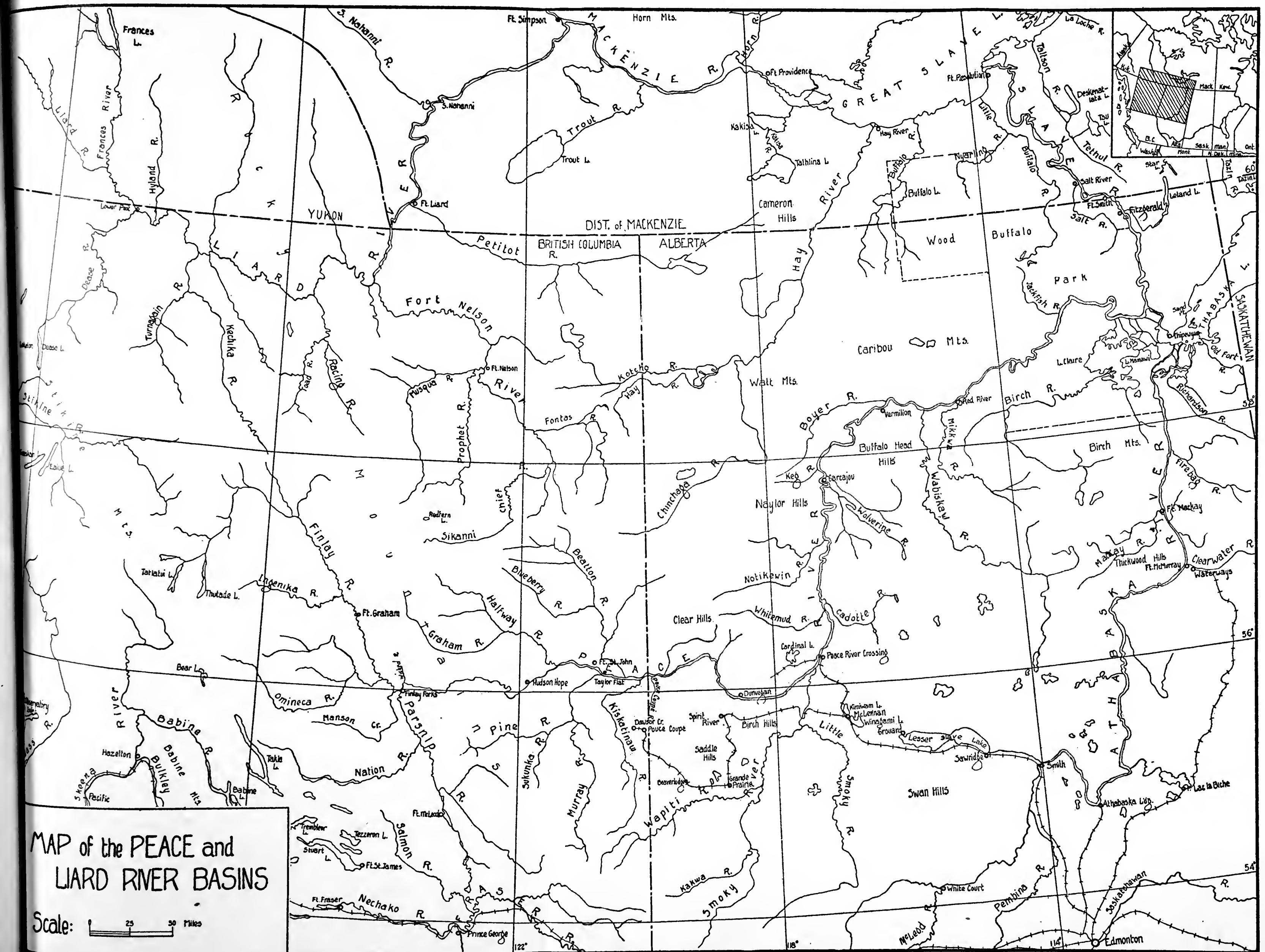
1. *ARNICA OBTUSIFOLIUS* var. *ACUTA* Raup.  
2. *ANTENNARIA ATRICEPS* Fernald.





ANTENNARIA MEGACEPHALA Fernald.





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